EDWARDS AIR FORCE BASE

DESIGN STANDARDS

JANUARY 2017

412th Civil Engineer Group

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The Edwards Air Force Base Design Standards are designed as a source document to allow project managers and contractors a foundation for all construction projects whether they are new construction, building alteration or maintenance and repair.

These Design Standards are authorized/approved by the Base Civil Engineer (BCE), 412th Civil Engineer Group. The BCE is the sole authority for revisions to these Design Standards. Annual review and revisions to these Design Standards occurs every January. Comments and proposals for revision require submission by 1 December for consideration/ inclusion. All proposed changes must be submitted by e-mail to Mr. Hugo Via, Chief, Project Execution, at hugo.via.2@us.af.mil.

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Chapter 1 Introduction

Facilities' design, construction, operation and maintenance at Edwards Air Force Base (AFB) shall be based on incorporation of industry standards and the systematic analysis of life-cycle benefits received for the cost incurred. Design of the physical plant shall ensure that the facilities are "fit for use" and provide facility conditions that effectively, efficiently and safely support Edwards AFB's current and future mission needs. In addition, sustainable design principles shall be applied from site planning to facility design, construction and operation to ensure resource efficiency of the building and improve the health and productivity of the occupants. The safety and health of the base employees, public and any possible impact to the environment, shall take precedence over project issues such as performance, cost or schedule.

These design standards are generally applicable to all disciplines on all projects. All construction, major/minor repair and renovation projects should be functional and cost effective. Facility projects shall be tailored to fit its intended function, with emphasis on low-maintenance and energy efficiency. Facilities should be constructed to be easily maintained, with readily accessible equipment areas and quality systems. To promote an orderly and efficient appearance, architectural features of new facilities shall complement and enhance existing architecture at the site.

Close coordination and development of civil, landscape, structural, architectural, fire protection, mechanical, electrical and security features are expected to ensure compatibility with planned functional equipment and to facilitate constructability.

1.1 General Design/Construction Requirements

A scope of work (SOW) describes the basic requirements, goals and design objectives of a project. Typically, this statement is written by the 412th Civil Engineer Group (412 CEG). The formality and detail of this SOW will vary depending on the size and/or complexity of the effort.

Timely submission of contract-required design and construction plans are essential to the achievement of a fully cooperative design that maximizes customer satisfaction. All design and engineering documents as well as construction and material submittals shall be reviewed by the Edwards AFB Fire Protection Division Technical Services Bureau and Air Force Civil Engineering Center (AFCEC), for compliance with Department of Defense (DoD) and Edwards AFB requirements.

The practice of architectural, engineering and design procedures where specifically regulated in applicable codes referenced by this Design Standard shall be complied with. The Unified Facilities Criteria, its ancillary Standards and Air Force (AF) Technical letters are in aggregate a Federal code that shall be viewed as the basic code. Specific areas of architectural and engineering design reserved for licensed professionals by California State Statutes and professional boards shall be respected. The requirements of the California Board of Architects, the California State Board for Professional Engineers, Land Surveyors, and Geologists, the provisions of the California Business and Professions Code, and the California Code of Regulations shall be met. Specialty design and construction of infrastructure systems shall be

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performed only by specialty contractors holding the appropriate type and Class of License as issued by the California Contractor State License Board. An Out of State Entity performing design and construction services at Edwards AFB may submit equivalent levels of competency as certified by regulatory agencies for their home state. For conflicts between Federal, State and Local regulations, the strictest shall apply. Design, Design-Bid-Build and Design-Build methods of construction documentation and delivery shall be the strictest and best of current industry practices as well as what is specified by all applicable regulations and codes.

It is not the intent of these standards to re-state specific Federal, State, AF or Local Standards. Reference to specific standards within this document is done for emphasis only, and must not be interpreted to imply that other legal and regulatory requirements are not required. These standards have no authority to overrule any State or Federal law or regulation. Any conflict between these Standards and other applicable standards must be brought to the attention of the 412 CEG Project Manager (PM) as soon as possible and timely resolution requested.

During the construction stage for all 412 CEG projects, if the customer is in a secure location and requires an escort, it is the program (customer) responsibility to provide an escort for contractor personnel. The 412 CEG and/or United States Army Corps of Engineers (USACE) are not responsible to provide contractor personnel escort to the construction sites in required areas.

Key Concepts

Energy and Water Conservation. New construction, substantial remodeling or large energy or water consuming system replacement will not be done without connecting that facility or system into the existing Energy Monitoring Control System/Supervisory Control and Data Acquisition (EMCS/SCADA) system. Water conservation measures are to be designed into and implemented on all new construction or substantial remodeling projects. More information on EMCS/SCADA can be found in Chapter 8.

Utility and Water Metering Requirements. All new utilities, including water installations, must be metered. Metering is required at each individual facility. Sub-metering within facilities is acceptable if required to determine energy and water use across organizational lines or if significant processes for energy or water use differences exist. Meters must be compatible, remotely readable and connected to the current EMCS/SCADA system. More information on EMCS/SCADA can be found in Chapter 8.

EMCS/SCADA Integration. The heating, ventilation and air conditioning (HVAC) and lighting systems of many buildings on Edwards AFB are currently integrated into our base-wide EMCS/SCADA system. The operating characteristics of existing and new equipment and the connectivity of these buildings to the EMCS/SCADA system must not be diminished by any building revisions. Facilities not currently integrated into the base-wide EMCS/SCADA system undergoing significant HVAC upgrades or large system replacements, must include full and effective system integration as part of the upgrade or replacement.

Architectural Barriers Act (ABA). Edwards AFB maintains compliance with all legal requirements of the ABA. All new facility construction and renovations must meet prescribed ABA standards as specified by the 2015 International Building Code (IBC) and the 2016 California Building Code (CBC) (updated versions and/or amendments to these documents

should be used). In the event of conflict, the code standard resulting in the greatest accommodation will apply. Any military or special-use exclusion, consistent with the ABA, must be noted and documented.

National Historic Preservation Act (NHPA): Edwards AFB maintains compliance with all legal requirements of the NHPA. All building alterations or maintenance and repair must meet prescribed NHPA standards and the standards of the Secretary of the Interior. Early identification of historic properties is integral in facilitating the NHPA compliance process.

1.2 Project Siting and Site Construction Limit Requirements

Prior to design, construction projects are reviewed specifically to determine the best acceptable site. Often, a project is granted siting approval subject to a variety of conditions which must be adhered to in the design and construction of the project.

The site parameters vary with each project, including but not limited to concerns such as access, parking considerations, utility relocations, flood plain issues, noise proofing requirements and environmental concerns. To determine the specific restrictions associated with each project site, the Contractor and the PM must contact the Community Planner. Any change in the site location of a facility, even those minor in nature, must also be coordinated with the base Community Planner and appropriate actions and/or approvals sought prior to construction.

1.3 Job Site Standards, Contractor Storage and Laydown Areas

When projects are under design or in planning, specific areas will be designated where contractors locate a construction office trailer and stockpile tools and materials. These areas will be designated by facility managers responsible for the land used by the construction effort. The locations will be as convenient as possible to the work site where visual impact to the rest of the installation will be minimal. The PM will review all locations proposed for on-site construction office trailers and approve the location as a pre-construction conference agenda item. Edwards AFB may limit the number and location of various construction and office trailers, temporary structures and open storage and staging areas used by the contractor. These facilities are to be clean, in good condition and free of rust or surface deterioration. Specifications to enforce these requirements shall be included in each project. The following specific requirements apply:

- Portable toilets needed by the contractor will be permitted at the construction site at a location that minimizes the visual impact and shall be within the construction fence
- When fencing is required to restrict access, impact to construction work or to provide site safety, fencing shall consist of conventional chain link fence and will be screened
- All required signs for construction shall be combined into a single on-site sign. This sign shall include information on the standard USACE project information (for those projects where applicable) and the contractor's business name
- Mandatory "Hard Hat Area" signs will be posted as safety regulations dictate
- Construction office trailers shall be in good repair and of minimum size

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The preservation of all natural resources including the undisturbed desert areas within the main base cantonment area requires the minimization of laydown and construction assembly and storage areas, as well as strict limitations on the area of construction-related disturbance on the site. All site disturbances during and throughout construction on previously undisturbed sites must be limited to:

- 40 feet beyond the building perimeter
- 10 feet beyond surface walkways, patios, surface parking and utilities less than 12 inches in diameter
- 15 feet beyond primary roadway curbs and main utility branch trenches
- Any laydown or staging areas outside the construction site must receive approval prior to utilization

If larger staging areas are required to limit compaction on previously constructed areas with permeable surfaces (such as pervious paving, stormwater retention facilities and playing fields), disturbance up to 25 feet is allowed and will be permitted on a case by case basis.

Utility connections from contractor owned/leased office trailers on the construction site can be established at the expense of the contractor, not the government. Infrastructure may not be provided directly to the site. However, pending availability, it can be utilized by the contractor. Utility mains may be a significant distance from construction; the contractor is responsible to connect utilities at their expense. Utility usage requirements shall include, but are not limited to the following:

- Minimize idling of construction equipment
- Turn off lights when an area is not occupied
- Reduce heat when an area is not occupied
- Provide enclosures to prevent unnecessary heat loss from building envelope
- Minimize water use

When storage area and or laydown areas are no longer needed, the contractor is responsible for all clean-up efforts and any costs that may be incurred due to environmental remediation caused by the contractor. Contractors are required to clear the work site with the PM prior to end of contract.

Depending on the contract, sometimes it is not feasible to have a laydown or storage area co-located to the work site. If this is the case, a laydown area on Contractor Hill Road will be provided as the official area for the contractor. This area will be based upon the contractor's requirements. A specific space assignment will be designated after contract award by the 412 CEG Community Planner. The contractor will contact the Community Planner at (661) 277-9456 prior to mobilizing and request a space through that office. The designated lot on Contractor's Hill Road will be used for the contractor's office trailer, vehicle parking and supply storage. The site office shall be manned continuously during standard working hours, and have the Contract Manager onsite. The contractor shall be responsible for the connection of all utilities.

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Once the performance period of the contract or last task order has ended and upon notification from the Contracting Officer, the contractor shall contact the 412 CEG Community Planner to schedule a move-out inspection prior to leaving the site. Under no circumstances will any equipment, trailers, portable buildings, conex type facilities or any other structures be left on site once the contract is complete. In addition, no waste of any kind, non-hazardous or hazardous will be left on site. The site will be reverted back to its original condition prior to its current use. Before departure, the contractor shall contact the Contracting Officer, Contract Manager and 412 CEG Community Planner for the final move out inspection before leaving the base. Any deficiencies noted will be corrected by the departing contractor before vacating the space.

1.4 Computer Aided Design (CAD) Requirements

The as-built drawings shall be delivered in the form of digital media, plots and related documents to comprise a complete set of drawings for evaluation and approval to the PM. All dimensions shall be expressed in English Imperial (inch-pound) and Standard International metric units.

Red-lined as-built drawings will be developed and submitted on 30 inch x 42 inch sheets. The as -built drawings shall be complete, detailed drawings and shall accurately depict the as-constructed or as-built conditions of the project. All reproducible material shall have sufficient contrast to reproduce clear and concise prints. All red-lined as-built drawings shall be stamped "AS-BUILT" and must be signed and dated by the contractor to reflect dates as-built corrections were made to the digital graphic as-built files.

Digital Files. Where contractors include inspection of construction, all changes made to the design during construction shall be indicated in the CAD drawing files. The revised CAD files must be a true representation of the final as-built construction. All graphic information on consolidated composite drawings (CCDs) and shop drawings provided by the construction contractor, shall be merged into the CAD files. Where CAD graphics are duplicated on CCDs or shop drawings, the duplicates will be deleted leaving a single copy of each graphic element in the revised CAD file. The revised CAD files shall be delivered to 412 CEG, Engineering Division, Execution Support Office (412 CEG/CENME) within 90 days after completion of construction.

The completed as-built drawings which incorporated all field corrections/changes shall be delivered in digital CAD format on a compact disc. Each drawing shall utilize the standard Edwards AFB title block and follow the prescribed parameters. All digital graphic files will conform to the Tri-Service Standard A/E/C CAD Standards, which 412 CEG/CENME will provide in digital format upon request.

Format Specific Requirements. All files submitted in *AutoCAD*® format shall conform to the following requirements:

- All external reference files or "XREFS" used to create a particular sheet in the drawing package shall be "bound" and "inserted" into the source file sheet. CAD files with multiple sheets or drawings are not acceptable. Each drawing sheet should be represented by only one CAD file

- Limit the use of all text in each drawing to standard *AutoCAD* ® font files available on the *AutoCAD*® software distribution cd only
- If a non-standard color table file or ".CTB" is used, it must be provided on the delivery cd

All files submitted in *Microstation*® format shall conform to the following requirements:

- The reference files used to create a particular sheet will be permanently attached to or merged with the source file sheet
- Limit the use of all text in each drawing to standard *Microstation*® font files available on the *Microstation*® software distribution cd only
- All non-standard color tables ".TBL" files used will be provided on the delivery cd

Record Drawings. The prime contractor shall be responsible to field verify all as-built drawings as the AF or the Government does not guarantee their accuracy. The Base Civil Engineer (BCE) does not have the supplies to provide in-house reproduction capability. The contractor shall either provide paper supplies for the required copies or arrange to have drawings reproduced by an outside vendor at their own expense.

1.5 Standard Design References and Criteria

The prime contractor shall be responsible for obtaining all required publications. Many publications are available on the internet. AF, Air Force Materiel Command (AFMC), Air Force Test Center (AFTC) and Edwards Air Force Base Instruction (EAFBI) publications may be obtained through the Edwards AFB public website, http://www.edwards.af.mil under Publications & Forms. Other AF-related publications may be requested through the assigned PM. All references in this document, Codes, Handbooks and other design criteria, including AF and DoD design criteria refer to the most recently published version at the design start or at time of specification.

Unified Facilities Criteria (UFC)

All design and construction documents shall be in conformance to all specifically cited codes and standards and with the most recently issued DoD UFC including but not limited to the following:

UFC 1-200-01	*General Building Requirements*
UFC 1-300-07A	*Design Build Technical Requirements*
UFC 3-301-01	*Structural Engineering, includes Change 2*
UFC 3-110-03	*Roofing*
UFC 3-210-02	*Privately Owned Vehicle Site Circulation and Parking*
UFC 3-230-03A	*Water Supply*
UFC 3-230-4A	*Water Distribution*
UFC 3-230-9	*Water Supply: Water Storage*
UFC 3-230-10A	*Water Supply, Water Distribution*
UFC 3-230-19N	*Water Supply Systems*
UFC 3-240-4A	*Wastewater Collection*
UFC 3-240-6A	*Wastewater Collection and Pumping*
UFC 3-250-01FA	*Pavement Design for Roads, Streets, Walks, and Open Storage Areas*

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UFC 3-260-02	*Pavement Design for Airfields*
UFC 3-270-07	*Airfield Damage Repair*
UFC 3-310-01	*Structural Load Data*
UFC 3-310-02A	*Structural Design Criteria for Buildings*
UFC 3-310-04	*Seismic Design for Buildings*
UFC 3-320-05A	*Structural Design Criteria for Structures Other than Buildings*
UFC 3-330-03A	*Seismic Review Procedures for Existing Military Buildings*
UFC 3-410-04N	*Industrial Ventilation*
UFC 3-420-01	*Plumbing Systems*
UFC 3-430-01FA	*Heating and Cooling Distribution Systems*
UFC 3-430-05FA	*Gas Distribution*
UFC 3-430-09N	*Exterior Mechanical Utility Distribution*
UFC 3-520-01	*Interior Electrical Systems*
UFC 3-530-01	*Design: Interior and Exterior Lighting and Controls*
UFC 3-550-01	*Exterior Electric Power Distribution*
UFC 3-560-01	*Electrical Safety, O&M, with Change 4*
UFC 3-600-01	*Fire Protection Engineering for Facilities*
UFC 4-010-01	*DoD Minimum Antiterrorism Standards for Buildings, includes Change 1*
UFC 4-023-03	*Design of Buildings to Resist Progressive Collapse*
UFC 4-211-01	*Aircraft Maintenance Facilities*
UFC 4-021-01	*Design and O&M, Mass Notification Systems, Change 1*

1.6 Commitment to Sustainable Design

Edwards AFB is committed to sustainable design in all its aspects. The AF has instituted a Sustainable Design and Development Policy in 2007 which reinforces the importance of sustainable development concepts in the planning, design, construction and operation of facilities and infrastructure. Beginning in FY09, 100 percent of each Major Command's (MAJCOM) military construction (MILCON) vertical construction projects, with climate control, shall be designed so that it is capable of achieving the United States Green Building Council's (USGBC) Leadership in Energy and Environmental Design (LEED) Silver certification. For projects (horizontal, utility and industrial) that do not fit the traditional definition of LEED, consideration shall be given for the incorporation of LEED principles where financially feasible. Detailed requirements for these items are found in the USGBC *New Construction and Major Renovation Reference Guide, Second Edition.*

Chapter 2 Architecture

This section of these standards is intended to provide the minimum standards, procedures and materials for facilities at Edwards AFB. All new facilities and additions built on Edwards AFB should be compatible with the permanent facilities already in existence and in compliance with the historic preservation standards, if applicable.

Color, texture and pattern must all be considered not only in the context of the building being designed, but also in the larger context of the site and neighboring buildings. Durability and low maintenance are also vital to a successful design.

Development of base facilities shall adhere to a general architectural style which includes sophisticated and modern solar control features – deep overhangs, recessed windows and wind and weather protected entrances and exits.

2.1 Base Facility Color Scheme

Dunn-Edwards Nomenclature is as follows:

- Base Exterior Color: Marble Creme
- Primary Accent/Trim Color: Nebular Redwood
- Secondary Accent/Trim Color: Big Stone Brown
- Interior Color: Swiss Coffee

When ordering paint from Dunn-Edwards, please call (661) 224-1988 and indicate you are calling for paint to use at Edwards AFB. Only those in the Edwards AFB Facility Color Scheme are acceptable colors for painted or factory finished items. If deviations from the base color scheme are desired, they must be justified by considerations rather than convenience or cost. Deviations are permitted only with the specific approval of the BCE. The prime contractor will submit the color samples for approval prior to application.

Paints. All paints/coatings shall comply with Eastern Kern Air Pollution Control District (EKAPCD), Antelope Valley Air Quality Management District (AVAQMD), Mojave Desert Air Quality Management District (MDAQMD) volatile organic compound (VOC) requirements of 100 grams/liter VOCs, unless the coating meets the definition of a specialty coating. For a list of definitions and the VOC requirements of specialty coatings, please contact the Environmental Management Division (412 CEG/CEV). The use of lead-based and lead containing paint is prohibited.

Facility Equipment, Fixtures and Accessory Colors. All facility equipment, fixtures and accessories are to be finished in accordance with (IAW) the Edwards AFB Paint Plan. This requirement includes any such item installed as part of a construction, infrastructure or utility project. Colors that have been selected for specific items of facility equipment are:

- Fire Hydrant Color Coding At facilities which have hydrants on both potable and non-potable water systems, fire hydrants must be color coded to avoid cross-connections during firefighting. Hydrant barrels shall be red for non-potable water

and yellow for potable water. Regardless of water source, hydrant bonnet and cap color shall be IAW the National Fire Protection Association (NFPA) 291, *Fire Flow and Marking of Hydrants*, based on flow capacity.

- Aboveground Storage Tanks (AST) for Water shall be painted Marble Creme with Nebular Redwood stripe painted around the tank from 1/2 to 3/4 of the height of the tank. The tank number will be painted Marble Creme in the stripe.
- Unleaded Fuel ASTs shall be painted white IAW the State of California Air Resources Board Executive Order VR-301-D *Standing Loss Control Vapor Recovery System for Existing Installations of Aboveground Storage Tanks.*
- Bulk Fuel Storage Facilities or ASTs shall be painted High Gloss White FS17925. The colors assigned shall conform to the requirements identified by numbers specified in FED-STD-595. The North Atlantic Treaty Organization symbol of a product and tank numbers shall conform to MIL-STD-161H. The tank numbers shall be painted in white with a black background. Black No. 17038 and White Gloss No. 17875/17925 are assigned, without significant meaning, for general use as indicated in this standard.
- Building Equipment/Accessories/Safety Equipment such as louvers, recycle bins, dumpsters, loading dock bollards, safety, railings and other safety equipment not regulated by the Occupational Safety and Health Administration (OSHA) or AF safety regulations - select the base, accent or trim color that will contrast with the adjacent background color.
- Post indicator valves shall be painted Big Stone Brown if they are located more than 20 feet from the building. They shall be painted to match the adjacent wall surface if they are closer than 20 feet to the building.
- Utility Posts shall be Big Stone Brown.
- Fire bells and Eyewashes should not be painted. Obtain them in factory-finishes compatible with the surface they are mounted on.

2.2 Exterior Design

Renovations or alteration projects shall improve the development of the facilities with complementary features which are similar to the existing facilities and with features of the Edwards AFB architectural style.

Metal. Metal siding and roofing panels are used throughout Edwards AFB as architectural elements/finishes. Metal coatings and sidings shall be factory finished with coatings to match the Edwards AFB Facility Color Scheme. Exceptions include the anodized finish on a metal window and door trim, and primer paint applied as a factory finish to be painted at the job site to match door frames. Approved uses within the appropriate areas will be approved on a case-by-case basis.

The color of choice for a standing seam metal roof is Dunn-Edwards' Nebular Redwood trim color, unless the facility is so large (like hangars) that surface color matching Dunn-Edwards' Marble Creme is considered for uniformity. Roof color determination must be coordinated in advance.

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Concrete. Concrete should be natural gray, depending on its relationship to gray walking surfaces, and/or it may have an integrated color to match or enhance neighboring architectural features or facilities. Painting exterior concrete is not allowed. Any concrete left as an unfinished element shall be aesthetically relevant.

Concrete Masonry Units (CMU). Split-face common block with integral color are highly recommended. Split-face CMU shall have integral color Desert Sand as manufactured by Desert Block Company, located in Mojave, California (or equal) (tan-colored block with dark brown aggregate). CMU used as an exterior element shall be sealed against water penetration according to the manufacturer's recommendations. Ribbed split-face block or common block in a course or two may only be used for accent purposes. Standard block may only be used when it is not seen as an exterior finish.

Exterior Insulation Finish Systems (EIFS). EIFS shall have a drainable system with fluted design and control joints. The EIFS shall have a minimum of 1-1/2 inches of undisturbed insulation excluding the depth of drainage flutes and architectural reveals, or manufacturer's recommendations. Integral colors must match the Edwards AFB Facility Color Scheme (special consideration and acrylic mesh reinforced construction for damage resistance to areas below 3 feet off the ground shall be applied to these finishes).

Stucco. Stucco final exterior finish texture shall be medium sand finish with accents in smooth trowel finish. Stucco color must conform to the Edwards AFB Facility Color Scheme. The finish system shall have a "C" channel or similar stop at all edges and not be allowed to dye into the next finish. Thin set stucco application over mesh adhered to self-draining channeled exterior insulation lighting finish systems is the preferred method of obtaining the stucco look.

Wood. Wood products are discouraged for use as exterior finish on buildings. Metal products should be investigated for use as wood substitutes.

Composite Building Panels. Composite building panels are acceptable for building wall construction. Panels shall match the Edwards AFB Facility Color Scheme.

Anti-Terrorism/Force Protection (AT/FP) Walls. Should be 18 inches tall, constructed of reinforced split face CMU backed with earth, have a flat CMU cap, and be Desert Sand color. Where access is needed for emergency responders or maintenance vehicles, removable bollards or security gates will be used in compliance with UFC 4-022-03, *Security Fences and Gates*.

Other Finishes. Uses of other systems and/or finishes will be considered on a case-by-case basis, unless otherwise dictated by historic preservation guidelines.

Entrances. Develop entrance areas providing a clear sense of arrival for the main functions of the facility. Use secondary spaces to identify avenues for traffic. Wind screening entry structures may be required, especially doors facing prevailing southwest winds. Design and materials used for these structures must match or accent the existing construction. Prior approval of materials and design are required.

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2.3 Roofing

All roofs on Edwards AFB require safety tie downs and ladders. All roofing systems must comply with the following, unless otherwise dictated by historic preservation guidelines. Roofs shall be designed to withstand uplift wind pressures of 110 miles per hour (mph) or higher. Wind uplift resistance of the complete roof assembly shall be rated Class I-90 IAW (Factory Mutual) FM P9513 or Class 90 IAW (underwriters laboratories) UL 580. All roof designs, requiring to withstand uplift pressures of more than 110 mph, will be stated on SOWs. Asbestos materials are commonly found in existing roofing at Edwards AFB. Note that all re-roofing projects must be sampled for asbestos at an appropriate time in the design phase. Acceptable metal roof systems include standing seam, architectural batten seam and mechanically lapped seams. MILCON roofs shall meet LEED Silver ratings.

Basic Requirements. Safety tie downs or lifelines must be installed on all new or re-roofing projects per OSHA Part 1926 and Air Force Instruction (AFI) 91-203, *Fall Protection Systems*, Core of Federal Regulations (CFR) 1926.450-500 subparagraphs L and M and UFC 3-110-03. All roofing used at Edwards AFB must have a Solar Reflectance Index of 29 or greater for roof slopes equal to or > 2:12 or 78 or greater for slopes < 2:12.

Roofs slope of at least 1/2:12 are required. Note that although the word “flat” may sometimes be used to refer to a low-slope roof, an absolutely flat roof is never permitted.

Built-Up Roofs (BURs). BURs approved for use must meet the following requirements: BURs shall be concealed by parapet walls; roof shall be a minimum 3-ply BUR with a mineral cap sheet; gravel on BURs is not allowed. BUR installation shall be scheduled to complete each area of work on the same day. Install temporary water cutoffs and tie-ins at the end of each workday. Remove temporary cutoffs and tie-ins on resuming work so that all vertical faces of insulation are exposed.

White Roofs or Cool Roofs. May be used on nominally flat roofs which enhance the desired effects/benefits of the white surface. The term “cool roofs” and “white roofs” shall be taken to mean a roof that meets state of the art geo-engineering standards for high solar reflectance and high solar emittance in its technical specifications. The standards are set by the Energy Star Program. For the visual aesthetics established by the base, only low slope roofs (preferably hidden by a parapet wall), may literally be white in color. These flat roofs shall have an Energy Star rating of .78 initial and .50 aged. Note: These roofs are not necessarily white in color.

Roofs that are clearly visible shall maintain the visual character and aesthetics of Edwards AFB. Large, arched clear spanned structures such as hangars that are roofed with monolithic sheet may become cool roofs with a Marble Creme color to match the standard. Monolithic roofs shall have an initial reflectivity of .65 and weathered reflectance of .50, with a life cycle expectancy and warranty period for durability of conventional roofs.

Standing Seam Metal Roofs. Standing seam roofs shall be shop fabricated. On-site fabrication of panels is not acceptable. Roof panels with lap type longitudinal side joints or those requiring battens, gaskets or other non-integral sealing means or exposed structural fasteners are not acceptable. Standing seams must wrap onto and down the fascia whenever

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used. Roof panels shall be fastened to the secondary support members with a concealed clip or backing device of steel having a protective metallic coating. Through penetration of the roofing surface by exposed fasteners shall occur only for non-structural flashing connections at terminal locations of the roof panels.

Standing metal seam roofs shall be sloped a minimum pitch of 1/2 inch per 12 inches, to a maximum pitch of 6 inches per 12 inches. If installation is over an existing roof, provide positive free air ventilation between the new and old roof. Low profile vents shall be incorporated into the roof. Low profile intake ventilators shall be provided near the new eave line. The ventilators shall be constructed and finished to match the roof panels.

Roof hold-down clips, penetrations and terminating flashings must allow the weathering metal membrane and its components to expand and contract uniformly with temperature variations. Special care must be used if panel runs exceed 50 feet.

A minimum of 2 inches of vapor retarding faced insulation shall be provided for noise and condensation control. Insulation shall be installed under the metal panel regardless of thermal insulation values required.

Visible standing seam roofs shall always be Nebular Redwood in color. There are advanced coatings that significantly increase the reflectance properties of the roof regardless of color. Wherever economically feasible, standing seam roofs shall be specified with limited runs of coatings with highest reflectance values available. The standard for non-low slope roofs shall be a reflectance initially of .25 and .15 aged.

Fascia panels shall be back coated for protection of the interior surface. Color shall match Dunn-Edwards' Nebular Redwood color.

Eave trim shall be factory coated with color finish to match. All rooftop equipment and round roof openings larger than 13 inches in diameter shall be integrated into the new roof systems using aluminum curbs. All of the curb joints shall be welded. Round roof openings 13 inches in diameter or smaller may be flashed to the new roof using either welded aluminum curbs or a flexible propylene diene monomer rubber flashing with aluminum sealing ring base. Any roof openings shall be structurally supported around all edges by the sub framing system.

Roof Service Walkway. Provide rubber chip walk treads or other approved systems on roofs from access ladders to sides of mechanical equipment where seasonal maintenance is required.

Equipment Curbs. Curbs shall be provided at all rectangular roof penetrations and at round piping which exceeds 8 inches in diameter. Curbs shall be a minimum height of 8 inches above the roof.

Drains, Gutters and Downspouts. Use of internal roof drains is discouraged. Gutters shall be fabricated in one continuous piece without joints. Downspouts shall be fabricated rectangle or round, corrugated with flat lock seams and 4 inches in size. Downspouts shall terminate at ground level by means of an elbow, polyvinyl chloride boot, cast iron boot or splash block.

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Rooftop Equipment. If at all possible, placement of rooftop mechanical and utility equipment shall be avoided. However, if no other viable alternative exists, the designer shall consider concealment of this equipment via parapet or screening compatible with the existing facility.

Roof Ladders. All new roof projects must have OSHA compliant ladders. Roof ladders shall be installed with safety cages and locking secure devices per CFR 1926.1053-19 I, II and III. Interior ladders must meet the edge distances and handrail requirements of the IBC. The roof ladders shall be painted to blend in with the wall to which they are attached.

Overhangs & Shading. Solar protecting overhangs and recessed windows are recommended in all new construction.

Insulation. Buildings on base shall be provided with a minimum composite wall system net insulation value of R-19 as well as a composite roof system net insulation value of R-38, or as required by California Title 24 Requirements in effect at the time of project award, whichever is greater.

Facades, Fascia and Soffits. Facades, fascia and soffits are used in varying degrees around Edwards AFB. Administration and dormitory facilities are normally constructed with deep 18 to 24 inch fascia where the roofing material is dropped vertically along the distance of the fascia. This general rule is relaxed on the flightline with smaller fascia. The facades of new facilities should blend into the style of facades used on surrounding buildings.

2.4 Windows and Doors

Door and window framing systems shall be factory finished with medium-bronze anodized finish or match building door hardware and lockset color. All frames shall be mitered and welded. Material submittals are required for these items. All structurally significant door and window framing systems must comply with historic preservation guidelines whenever appropriate.

Framing for buildings in the flightline area may be steel painted Nebular Redwood color to match the base color standards for steel doors and frames. Fixed windows shall be used in buildings with air conditioning systems. Windows shall be positioned and sized to minimize the solar heat load and maximize views to facility occupants. Views and day lighting provided to building occupants shall be devised to maximize their effectiveness. Skylights, light tables and other strategies are considered feasible to provide supplemental interior lighting. Protect interiors from heat gain and glare through the use of high-efficiency window glazing or other techniques.

Doors, Hardware and Locksets. Doors shall be durable and easily maintained. Main entrance doors, other than storefront bronze and glass, may be of steel construction painted Nebular Redwood to match painted steel framing. Secondary entrances and all other doors and frames shall be painted the color of the adjacent wall. Galvanized metal doors must be painted. Interior doors shall be compatible with the function of the area where they are to be installed. Use solid core wood doors for general interior office areas. In industrial areas, use painted metal doors. Hollow core wood doors are not allowed.

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Exterior doors shall be operable with no more than 8 pounds sustained pull required. Interior doors shall be operable with no more than 5 pounds sustained pull required. Doors shall consist of the following types:

- **Aluminum doors.** Aluminum doors shall be 1 3/4 inch thick with 3 inch wide top rail and vertical styles, medium-bronze anodized finish, factory applied weather stripped, with square glazing stops and a 10 inch high bottom rail and threshold.
- **Steel doors.** Steel doors shall be flush design, 1 3/4 inch thick with steel grid core or steel stiffened core.
- **Wood doors.** Wood doors shall be 1 3/4 inch, solid core birch hardwood veneer flush face doors. Locksets shall be appropriate to function. All doors shall have silencers (except where weather-stripping occurs). A 16 inch high minimum mop/ kick plate shall be provided at the kick side of all wood doors. Door hardware and locksets shall be factory finished. Medium or satin or oil-rubbed anodized bronzed finish is recommended for office spaces and conference rooms. Bright or satin nickel plated finish is recommended for bathrooms. In all cases, hardware and locksets should match the building door and window framing system color. Standard -sized door levers in lieu of door knobs shall be installed for handicapped-access. Heavy-duty locks shall be installed on high-traffic doors and medium-duty locks for light traffic doors. Door hardware plans and submittals shall be coordinated with the 412th Civil Engineer Squadron (412 CES) and approved by the BCE prior to purchase or installation. Locksets shall be compatible with the existing base Schlage® master keyway system. Locksets shall have Schlage® full-size large format IC cores. Main Base areas use a 6-pin keyway system. All material submittals are required for approval.

2.5 Walls and Ceiling

Good design extends beyond aesthetics to provide professional durability, acoustic and energy-saving value, as well as morale enhancement for the inhabitants. The goal is to ensure the interior appearance of each facility is based on carefully established professional design standards rather than arbitrary personal preferences.

Walls - Interior Finishes. Only low-VOC adhesives, sealants, stains, paints and coatings are allowed for interiors. Authorization for use of all low-VOC adhesives, sealants, stains, paints and coatings shall be obtained from the Contracting Office prior to being brought on Edwards AFB and submitted to the Base Hazardous Material Program Manager, IAW AFI 32-7086, *Hazardous Materials Management,* 2004 sections 2.5.5.2.3 and 2.5.5.2.4.

Gypsum board shall be primed and painted with a minimum of two coats of paint. Light texture paint is preferred. Texturing material shall be white, vinyl base, a formulation suitable for troweling or spraying consistency. Wall and ceiling texture shall be orange peel. Concrete or concrete block shall be furred and finished with gypsum board finish, primed and painted.

Wall coverings shall have characteristics of good durability and easy maintenance. They should be passive colors with subdued patterns and used for accent walls only. Wall base type to be used shall be considered for compatibility with other facility features and selection based on

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functional, economic and aesthetic qualities required. Paneling shall be used only with approval for specific projects.

Wall and Corner Guards. Plastic or other synthetic trim material shall be compatible with other components in function and fire rating. Bullnose corners shall be provided on gypsum wallboard walls and corner guards and chair rails shall be used to protect wall coverings.

Ceilings. Ceilings constructed with gypsum board shall be primed and then painted a minimum of two coats.

Suspended acoustic ceiling tile system shall be 24 inch x 24 inch grid system capable of carrying recessed light fixtures. Acoustic tile shall be 24 inches x 24 inches by 5/8 inch, regular lay-in type. Ceiling tile systems should be installed in a regular pattern without borders and joint lines parallel to wall. Install symmetrically above the centerline of each room or space. A recessed grid with drop edge tile is preferred.

Trim. Trim shall be compatible with other components of the facility and have the following features listed below:

- Wood trim shall be stained or painted
- Trim to be stained or clear finish shall be stain grade
- Hardwood used for trim shall be certified by the FSC
- Metal door frame trim shall be painted
- Plastic or other synthetic trim material shall be compatible with other components in function and fire rating
- Vinyl cove base shall be 4 inches minimum

2.6 Architectural Glass

Architectural glass shall be single openings in an otherwise solid wall of opaque materials due to energy conservation concerns. Walls of glass shall be window-wall construction in single-story applications. Multi-story walls of glass shall be curtain-wall construction. Glass shall be double pane with low emissivity and medium bronze in color and in tint. Reflective glass and reflective treatments of any sort in the visual sense is prohibited. Panes subject to normal impact hazards shall be tempered per code. All architectural glass must comply with historic preservation guidelines whenever appropriate.

Spandrel glass shall be used to cover construction materials and if desired, between certain sections of a building to include the area between floors, columns, ceiling and other small or large spaces. All spandrel glass shall be medium bronze in color, low emissivity and will be further insulated with integral rigid insulation or installed over an insulated wall assembly. Visually reflective spandrels are prohibited.

All glass wall framing members shall be standard profile, extruded aluminum construction and medium bronze in color. They will have internal pressure equalization rain screen and weeping features and be internally self-draining.

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2.7 Flooring

Flooring shall have subtle pattern and colors and be durable and easy to maintain. Floor covering of hardwood, sheet vinyl goods (Federal Specification L-F-475a(3), Grade B or C), carpet or ceramic tile shall be provided and shall conform to one of the following (preferred) flooring systems:

- Concrete floors without any covering shall be limited to the industrial area facilities
- Painted floors require base approval where hangar and shop floor coatings shall be two-part water-based epoxy type paint, similar to Zoeller Guard or equal
- All paints, adhesives and stains used in interior flooring shall meet the VOC limits per the specification

Exposed wood flooring shall be limited to game rooms or similar special purpose rooms only. Wood subflooring is acceptable. Wood should be from recycled content whenever possible. Hardwood used shall be certified by the Forest Stewardship Council (FSC).

Vinyl tile flooring shall be a minimum of 1/8 inch thick and may be used where acceptable by code. A high quality vinyl composition tile with a through pattern shall be provided. Vinyl tile is preferred in high traffic areas. Type II commercial vinyl wall coverings are recommended for all areas. Muted neutral colors and subtle textures are preferred to strong patterns. Use of linoleum and other natural renewable resources for flooring is encouraged.

Raised Floor Systems. Raised floor systems shall be bolted stringer type and it shall meet IBC seismic codes and the support and under floor space requirements of the user. The raised floor system shall be grounded for safety hazard and static suppression as required by the user for computer protection.

Walk off Flooring. Provide recessed walk off flooring in traffic lanes for all main entrance foyers.

Tiles and Countertops. All permanent finishes for ceramic tile, counter tops, vinyl tile, etc. shall be neutral tones. Richer accent colors may be used only in small areas. Classic timeless textures and colors are desired and trendy patterns and colors shall be avoided. Further detail and assistance may be obtained from the BCE. Ceramic tile shall be thin set over concrete only. Ceramic floor tile shall be unglazed with grout color to coordinate with the tile color selected. Use unglazed porcelain tile in bathrooms and wet environments.

Carpets. Authorization for use of all carpet and carpet cushion adhesives shall be obtained from the Contracting Office prior to being brought on Edwards AFB and submitted to the Base Hazardous Materials Program Manager, IAW AFI 32-7086, sections 2.5.5.2.3 and 2.5.5.2.4. All adhesives/coatings shall comply with EKAPCD, AVAQMD and MDAQMD VOC requirements of 100 grams/liter, unless the coating meets the definition of a special coating. For a list of definitions and the VOC requirements of special coatings, please contact 412 CEG/CEV.

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Carpet shall be compatible with the function of the area where it is being installed. Patterns which blend in soil and shoe marks and traffic pattern wear are preferred. Carpet shall have the following characteristics:

- Static-free
- Woven, tufted or fusion bonded
- Plush cut, frieze (twist), cut and loop, or loop
- Medium face weight: 32 ounce, plush cut; 28 ounce, cut and loop or frieze (twist); or 24 ounce loop pile
- Carpet gauge shall be 1/8 inch or 1/10 inch
- The carpet shall pass the Department of Commerce (DOC) FF 1-70 Pill Test (7 passes from 8 specimens) and the requirements of NFPA 101, *The Life Safety Code*
- The yarn shall be branded by the fiber producer, Nylon-6, 6, or Nylon-6, with a soil and stain resistant finish
- Carpet shall be selected from a neutral palette and shall have a pattern
- All carpet and carpet cushion installed shall meet the testing and product requirements of the Carpet and Rug Institute's Green Label Plus Program

Padding. May or may not be utilized based on selected carpet. Padding not to be used in high traffic areas.

2.8 Interior Appurtenances

Millwork and Cabinetry. Cabinets and drawers shall be wood construction with the same type of construction and outside appearance. Use of recycled wood products is encouraged. If hardware is used, it shall be certified by the FSC. Quality construction material and hardware which meets the requirements of the Kitchen Cabinet Manufacturers Association A161.1 and Builders Hardware Manufacturers Association A156.9 shall be used. No hardware pulls are allowed on cabinet doors and drawer fronts for cabinetry for housing, kitchen and bathroom areas. Hinges shall be European style, concealed, adjustable and self-closing type. Drawers shall have metal side slider rails with nylon rollers versus center rails. Countertops and splashes shall be high pressure laminated plastic on particle board. Color shall be subtle, basic colors from standard range of colors.

Pre-Wired Work Stations. All systems furniture shall be pre-wired. Systems furniture panels shall not block windows and access panels. Use systems furniture in open areas with minimum fixed walls and columns and provide adequately sized mechanical, electrical and communication rooms. Maintain the open office feeling by channeling traffic into passageways along the main axis of the buildings with clearly defined intersecting horizontal and vertical corridors.

Toilet Compartments. Toilet compartments in all administrative facilities shall have sinks in vanities. Free standing sinks are not allowed unless required to accommodate handicapped access. Large full width mirrors shall be provided over the vanities. Small industrial mirrors over a sink are not allowed. Partitions shall be constructed of 1 inch thick minimum high-density polyethylene plastic. Toilet partitions shall be floor-mounted, overhead-braced and finished in colors selected from standard colors of the manufacturer. Low or very-low flow

sink and shower fixtures with integrated auto-off valves are required. Dual-flow toilet fixtures (1.6 gpf / 0.8 gpf) may be used in lieu of low (1.3 gpf) or very-low (1.0 gpf) flow single-flow toilets. Automated fixtures (automatic flushers/faucets) and waterless urinals are not permitted. Light switch timers are encouraged but must remain on for 30 minutes once activated. Hand blowers are permitted during major restroom renovations.

Interior Recycling Bins. An easily accessible area serving the entire building dedicated to the collection and storage of non-hazardous materials for recycling, including (at a minimum) paper, corrugated cardboard, glass, plastics and metals shall be provided and equipped in all buildings. Multiple areas may be required within large buildings.

Interior Handicapped Accessibility. Edwards AFB is dedicated to providing adequate handicapped accessibility in all facilities base-wide. All accessibility issues shall conform to the codes and guidance provided by the Uniform Federal Accessibility Standards (UFAS) or the ADA as outlined in the 2010 CBC, whichever provides less restrictive access.

Accessibility Following Maintenance and Repair. If existing elements, spaces, essential features or common areas are altered, then each altered element, space, feature or area shall comply with the applicable provisions of the UFAS and ADA.

Use of Military Exclusions. Edwards AFB will strive to provide UFAS and/or ADA compliant accessibility to all facilities regardless of any military exclusion granted by the UFAS. If use of the military exclusion is necessary, it must be identified, mitigating measures taken, if any, and a description of and reason why the exclusion was used provided and retained in the project file.

2.9 Signage

Interior Signs. Signage shall be provided for all rooms in new construction as required by UFC 3-120-01. Building directories and small bulletin boards shall be provided at the main entrance of all buildings. Additional bulletin boards may be provided in a central location, sized to handle permanent facility signs and posters such as fire exit plans. Floor directories shall be located at the top of stairways and at elevator lobbies. The size, type, information, etc. shall be as required by UFC 3-120-01. Lettering and background coloring shall be Marble Creme on Big Stone Brown.

Exterior Facility Signage. Non-traffic, non-directional signs may be made from Engineer Grade reflective sheeting (All traffic and all directional signs must be made from Type III, IV, or V High Reflective Retro-reflective sheeting.) All exterior signs shall have 3M engineer grade brown reflective sheeting applied to the backside. Brown paint will not be allowed. All poles must be Big Stone Brown. All poles installed in the clear zone of roadways must be mounted on frangible posts. Distinctive commercial signs (i.e. Army & Air Force Exchange Service (AAFES), Burger King) may be permitted by the Base Community Planner upon request.

Typically, exterior signs will not be illuminated. However, if illuminated, it must be illuminated from within or from ground-mounted spotlights and not from light fixtures mounted above or protruding in front of the sign. Electronic changing message signs are discouraged due

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to energy consumption and high maintenance costs. Although not desired, they may be approved on a case-by-case basis by the BCE and maintained at the owner's expense.

Standard Edwards AFB facility signs have been developed IAW UFC 3-120-01, *AF Sign Standard,* and templates are available from 412 CES Structures (412 CES/CEOHS).

Facility Identification. Facility Identification: Facility numbers should be painted on a wooden slate and attached to exterior building walls. They shall be maintained and/or replaced as needed. Newly-constructed facilities will also include painted facility numbers in the same manner unless expressly authorized by AFCEC. The facility number should be prominently on the vehicle-approach side of the structure, if there is no municipal street address.

Logos and Super-Graphics. Painted logos, racing stripes and similar super-graphics shall not be painted on new facilities. Existing graphics shall not be replaced when a facility is repainted. Organizational emblems shall be limited to the glass entrance doors.

Graphics on Edwards AFB should provide all information required to guide a first-time visitor on Edwards AFB to a particular destination and provide information about specific places or events. Hierarchy, materials, colors and concise messages must clearly communicate intent and be a unifying base element.

Sign Typography and Type Size. Helvetica Medium font is to be used for major information on all signs while Helvetica Regular font is to be used for secondary information on identification signs and as required on other miscellaneous signs. Helvetica Regular font (all caps) should also be used for all individually mounted, dimensional letters. Helvetica Medium should always be used when directional arrows are required in the sign message. Letter spacing standards must be IAW Unified Facilities Guide Specifications (UFGS) 10440 and UFC 3-120-01, *Air Force Sign Standards.*

Sign System Hierarchy The signage system is broken down into several subgroups visually associated with different functions. The subgroups chosen for Edwards AFB includes base identification, military identification, community identification, directional and information signs.

- Base Identification Signs: Name the installation at each of the main entrances
- Military Identification Signs: Identifies the large number of buildings that house a wide variety of functions
- Community Identification Signs: While the general character of these signs is the same as military identification signs, the background color may be different, they do not carry military emblems and they seldom carry building numbers
- Directional Signs: Direct vehicular and pedestrian traffic on Edwards AFB. These signs must be located in a logical, continuous progression from the point of entry to the desired activity along the roadway
- Information Signs/Kiosks: Provide educational or general information

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2.10 Exterior Installations

As a general rule, construction shall not be placed over existing buried water, sewer, electric or telephone utilities, except in extraordinary situations and then only if the BCE specifically approves. In no case shall any construction be placed over existing Petroleum, oil and Lubricants (POL) or natural gas tanks or lines. Furthermore, design and construction of exterior installations should minimize potential nesting sites for birds and shall install anti-perching devices to deter birds from perching on the structure.

Aircraft Shelters. Aircraft shelters must be engineered to withstand 110 mph sustained winds. They will be of standing seam roof design or heavy fabric, with metal posts anchored in 5 feet x 5 feet x 3 feet concrete footings or as designed and stamped by a licensed engineer. They will be Marble Creme color and may or may not have utilities run to them. All Aircraft shelters require authorization from AFMC and BCE prior to installation.

Bollards. Bollards are not permitted in roads or traveled ways without the explicit written permission of the BCE.

Bike Racks. Bike racks shall be constructed of metal with bronze anodized finish or painted Big Stone Brown. Bike racks providing spaces for 5 percent of peak building occupants shall be provided and installed in all new or reconstructed parking lots.

Cigarette Butt Cans. Butt can replacements shall be combination butt and trash can type and shall be color integrated cast concrete with textured finish. Butt cans are to be located in approved designated tobacco use areas only.

Equipment Pads. Equipment pads should be located behind the facility and screened with Edwards AFB-approved block wall. The screen walls shall be distanced from the equipment to ensure adequate clearance for maintenance and repair access. If located within 33 feet of a building, refer to UFC 4-010-01 for possible screening requirements. Gates for these enclosures shall be constructed of wrought iron bars the full height of the enclosure, painted to match the integrated color of the split-face blocks.

Equipment Screening. Exterior equipment must satisfy the requirements of UFC 04-10-01. Clearance between the equipment and the enclosure must allow for accessibility to maintenance personnel. Exterior equipment shall be screened with split-face block with integral color Desert Sand. No chain link fence screening is allowed.

Fencing and Screening. Two screening types are acceptable to reduce visual clutter on the installation. Consistency and durability are critical. Well-designed screens should not draw attention to themselves and should be used at a minimum. Under no circumstances is wood fencing allowed. The following are acceptable fencing and screening:

- **Masonry.** Selection of brick or concrete block must be compatible with the standards defined earlier in this chapter. The only allowable exception is when compatibility must be maintained with an existing facility. Grout shall be the same color as the split-face block.

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- **Chain Link Fencing.** Chain link fencing is acceptable as a screening device only when shrubbery is planted and maintained adjacent to the fencing and then only when necessary to maintain architectural compatibility with existing screening or other architectural elements.

Monuments, Displays and Flagpoles. All permanent displays including memorials, commemorative plaques, flagpoles and other static displays shall require coordination with the Base Community Planner for location and siting, with final approval from the BCE prior to installation. These will be reviewed on a case-by-case basis.

Furnishings. Color-integrated cast-concrete and/or medium-bronze anodized metal shall be the finish for site furniture and other elements. Designs shall be a modern appearance, damage resistant and have minimum maintenance requirements.

Kiosks. Kiosks or exterior bulletin board type signage shall match surrounding building trim. It shall be glass or Plexiglas enclosed and lockable**.**

Mechanical System Intakes. All system intakes shall be installed away from vehicle loading areas. Ventilation system intakes shall be located and/or protected IAW the requirements of UFC 4-010-01.

Shade Structures. All shade structures to include pavilions will be standing seam metal roof, with metal supports. They will have concrete footings and be placed atop a concrete slab. Color should be Nebular Redwood.

Trash and Recycling Receptacle Screening. Trash receptacle and recycling bin screening shall be constructed of split-face concrete masonry blocks with integral color Desert Tan and be medium weight. Solid gates shall be installed where complete screening is required.

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Chapter 3 Landscaping

Constructed landscapes are designed to moderate solar exposure, block the wind, control noise, screen bad or frame good views, control erosion, provide AT/FP measures and define the limits of an area. Attractive natural landscaping, using native or naturalized plants requiring minimal maintenance and water are desired. Topographic diversity should be created with berms and swales.

3.1 Requirements

Well designed and constructed landscapes include sloping landscaped grounds away from buildings and take into consideration grading, drainage, vegetation and irrigation systems to support them, surface treatment, lighting, furniture and site paving for pedestrians and vehicles. The result of a successfully designed landscape creates a pleasant pedestrian environment and managed spaces that transition from and are in harmony with the unique environment of Edwards AFB. The appearance of consistency and uniformity among individually landscaped sites is critical to ensure base-wide visual compatibility. All landscape plans must be submitted and approved prior to construction and all new landscapes must include delivery of a landscape maintenance plan.

3.2 Types of Materials

There are a wide variety of trees, shrubs, ground covers and flowering plants that will grow well in the High Desert climate of Edwards AFB. The landscape plan shall include plantings from a couple of categories so there will be a graduation of sizes, shapes and colors with plants grouped together to mimic nature. Consider mature growth to avoid planting too close to buildings or sidewalks. Use plants to hide obtrusive site elements like dumpsters, condensers and backflow preventers. Landscaping shall incorporate plants from the approved plant list found in Section 3.4. Plants used must be drought tolerant, and not on the California noxious weed list (http://plants.usda.gov/java/noxious?rptType=State&statefips=06). **Grass.** Grass requires the greatest amount of water and maintenance in landscapes and should be used sparingly. The use of grass turf is discouraged and should be limited to small areas of greatest impact. When grass is desired in a landscape, Hybrid Marathon Fescue grass will be used. Ensure proper soil amendments are provided to ensure greatest root growth and proper drainage. No sand base will be used for any grass turf installation. All landscaping materials from off-base should be certified weed-free to ensure compliance with E.O. 13112.

Trees. Trees shall be planted in groups of two, three or more to shade a window or a pedestrian walkway, as a wind block or to hide an unsightly view. Each tree shall have two bubblers for adequate watering and two posts to support the trees against the wind. Trees purchased for landscaping should be a minimum of 15 gallon or 24 inch box capacity. Mojave Desert native trees, to include Joshua Trees, may be transplanted under the guidance of an arborist.

Rock. Rock to be used as a finish ground cover shall consist of 1-1/2 to 2 inch California Gold or Bark Brown crushed rock, 2 to 4 inches thick. The earth base shall be thoroughly compacted

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prior to installation. Isolate the installation of imported rock from the compacted earth base with a weed mat or barrier layer. Use a porous nylon and vinyl fabric held in place with landscape staples. Plastic or "visqueen" material is not acceptable. Bark Brown and/or California Gold rock should be used for drainage swales where a stable ground cover may be necessary. Washed Arizona River Rock of varying sizes can be used for feature locations in xeriscapes.

Decomposed Granite (DG). DG can be used as a finish ground cover, at least 3 inches in depth.

Crushed Concrete. From Edwards AFB borrow pit is highly encouraged to support sub-base for new landscapes.

Boulders. May be incorporated in constructed landscapes and shall match the California Gold or Bark Brown landscaping rock. Boulders shall be embedded in the ground and clustered together in groups.

Containment or Concrete 'Mow Curbs'. Should be constructed to define edges of a specific medium and to more easily keep one material out of another. Mow curbs must be 2 inches higher than adjacent materials.

Site Furniture and Other Elements. A coordinated balance of site furnishings which complement the adjacent facility's architectural style is required. Consistency is the most critical factor in the selection of various site elements. Designers shall pay considerable attention to maintain compatibility with similar site elements within a particular architectural area on Edwards AFB. When no true compatibility exists, the designer shall coordinate material selection with the BCE.

Tables, Seating, Playgrounds and Picnic Areas. Tables and seating located in the public areas of the Main Base shall be cast smooth concrete and have an integral tan color compatible with the base paint scheme. Tables and seating located in the non-public areas of the Main Base may be metal with bronze anodized aluminum or painted Big Stone Brown finish. Playgrounds and picnic areas shall be contained with a concrete curb. Padding of synthetic impact attenuating surface material shall be installed as specified in UFGS-32 18 16.13. Padding shall not be installed adjacent to sand due to resultant slippery surfaces. Loose fill surfacing materials shall be engineered wood fill and be no less than 9 inches thick per the handbook for Public Playgrounds.

3.3 Irrigation System

An irrigation system shall be provided to sustain all planted landscapes, regardless of how drought-tolerant the plants may be. All exposed systems components subject to freezing shall be insulated.

Schedule 40 polyvinyl chloride (PVC) piping shall be used for all non-metal system components. Install swing-joints at all riser locations. Sub-surface piping shall be buried at least 8 inches below the finished grade. Bubbler heads shall be fully adjustable from 0 to 5 gallons per minute. Spray heads shall have a 6-inch pop-up riser and be fully adjustable for

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arc, radius and flow. Place and adjust sprinkler heads to prevent spray onto neighboring electrical equipment including pad mounted transformers, switches and electrical cabinets. All newly installed irrigation systems servicing landscapes greater than 1/4 acre in size shall be automatically and remotely readable and compatible, and connected with the current EMCS/ SCADA system. Additional EMCS/SCADA requirements are found in Chapter 8.

Reclaimed irrigation water may not be used in residential yards, child care facility yards or near restaurants. It may be used in public areas, including general use parks and athletic fields with use of public notification signage. The existing reclaimed water system should be used whenever possible.

3.4 Approved Plants

Select only plants included in the approved plant list provided for all new and replacement landscapes. Consider using sterile "naturalized" plants if available, so that there is never an issue of an "escaped" species that may become invasive in the desert ecosystem.

TREES

SILK TREE *Albizia julibrissin*

MEXICAN BLUE PALM *Brachea armaia*

DEODORA CEDAR *Cedrus deodara*

CANYON HACKBERRY *Celtis reticulata*

CHINESE HACKBERRY *Celtis sinensis*

HYBRID PALO VERDE *Cercidium* 'Desert Museum'

BLUE PALO VERDE *Cercidium floridum*

FOOTHILLS PALO VERDE *Cercidium microphyllum*

MEDITERRANEAN FAN PALM *Chamaerops humilis*

DESERT WILLOW *Chilopsis linearis*

CHITALPA *Chitalpa X tashkentensis*

COOLIBAH *Eucalyptus microtheca*

KIDNEYWOOD *Eysenhardtia orthocarpa*

RAYWOOD ASH *Fraxinus oxycarpa* 'Raywood'

ARIZONA ASH *Fraxinus velutina*

MODESTO ASH *Fraxinus velutina glabra* 'Modesto'

HONEY LOCUST *Gledistia triacanthos inermis* "Shademaster'

HOLLYWOOD JUNIPER *Juniperus chinensis* 'Torulosa'

CRAPE MYRTLE *Lagerstoemia indica*

CRABAPPLE *Malus X* 'Prairifire"

CANARY ISLAND DATE PALM *Phoenix canariensis*

AFGHAN PINE *Pinus eldarica*

ALEPPO PINE Pinus halepensis

ITALIAN STONE PINE *Pinus pinea*

CHINESE PISTACHE Pistacia chinensis

PURPLE LEAF PLUM *Prunus cerasifera* 'Atropurpurea'

BRADFORD FLOWERING PEAR Pyrus calleryana 'Bradford'

ESCARPMENT LIVE OAK *Quercus fusiformis*

WINDMILL PALM *Trachycarpus fortunei*

EVERGREEN ELM *Ulmus parvifolia*

CHASTE TREE *Vitex angus-castus*

CALIFORNIA FAN PALM *Washingtonia filifera*

SHRUBS

GLOSSY ABELIA *Abelia X grandiflora*

WHITE BURSAGE *Ambrosia dumosa*

SAND SAGE /SILVER SAGE *Artemisia filifolia*

FRINGED SAGE *Artemisia frigida*

'POWIS CASTLE' WORMWOOD *Artemisia X* "Powis Castle'

BIGLEAF SAGE *Artemisia fridentata*

FOURWING SALTBRUSH *Atriplex canescens*

JAPANESE BARBERRY *Berberis thunbergii* "Crimson Pygmy'

BUTTERFLY BUSH *Buddleia davidii*

YELLOW BIRD OF PARADISE *Caesalpinia gilliesii*

MEXICAN BIRD OF PARADISE *Caesaipinia mexicana*

PINK FAIRY DUSTER *Calliandra eriophylla*

LEMON BOTTLEBRUSH *Callistemon citrinus*

BLUE MIST *Caryopteris X clandonensis*

DESERT HACKBERRY *Celtis pallida*

WINTERFAT *Ceratoides lanata*

CURL-LEAF MOUNTAIN MAHOGANY *Cercocarpus ledifolius*

MOUNTAIN MAHOGANY *Cercoccarpus montanus*
TEXAS OLIVE *Cordia boissieri*
LITTLE-LEAF CORDIA *Cordia parvifolia*
ROCK COTONEASTER *Cotoneaster horizontalis*
BUSH DALEA *Dalea pulchra*
TURPENTINE BUSH *Ericameria laricifolia*
CREOSOTE BUSH *Larrea tridentata*
VIOLET SILVERLEAF *Leucophyllum candidum*
TEXAS RANGER (SAGE) *Leucophyllum frutenscens*
CHIHUAHUAN SAGE *Leucophyllum laevigatum*
OLEANDER *Nerium oleander*
FRASER'S PHOTINIA *Photinia X* "Fraseri'
CHINESE PHOTINIA *Photinia* serratifolia
WESTERN SANDCHERRY *Prunus besseyi*
POMEGRANATE *Punica granatum*
MEXICAN CLIFFROSE *Purshia maxicana*
PYRACANTHA/FIRETHORN *Pyracantha koidzumii*
SUGAR SUMAC *Rhus ovata*
SQUAW BUSH *Rhus trilobata*
MOJAVE DESERT SAGE *Salvia dorrii v. dorrii*
GREEN SANTOLINA *Santolina virens*
GREEN FEATHERY SENNA *Senna artemisioides v. filifola*
SHRUBBY SENNA *Senna wislizenil*
JOJOBA *Simmondsia chinensis*
TEXAS MOUNTIAN LAUREL *Sophora secundiflora*
ARIZONA ROSEWOOD *Vauquelinia californica*
SKELETON LEAF GOLDEN EYE *Viguier stenoloba*
HUMMINGBIRD TRUMPET *Zauschneria californica*
PFITZER JUNIPER *Juniperus chinensis* 'Pfitzeriana'
ARBORVITAE *Thuja occidentalis*
COYOTE BUSH -TWINPEAKS *Baccharis pilularis*

GROUND COVER

TRAILING DESERT BROOM *Baccaris X* "Starn Thompson'
DAMIANITA *Chrysactinia mexicana*
BUSH MORNING GLORY *Convolvulus cneorum*
CREEPING COTONEASTER *Cotoneaster adpressus*
GOLDEN DALEA *Dalea capitata* "Sierra Gold'
TRAILING DALEA *Dalea greggii*
TRAILING LANTANA *Lantana montevidensis*
NEW GOLD LANTANA *Lantana X* 'New Gold'
COPPER ICE PLANT *Malephora crocea*
MEXICAN EVENING PRIMROSE *Oenothera berlandieri*
SALTILLO PRIMROSE *Oenothera stubbei*
PROSTRATE ROSEMARY *Rosmarinus officinalis* "Prostratus'
CREEPING GERMANDER *Teucrium chamaedrys* 'Prostratus'
CREEPING THYME *Thymus serpyllum*
COMPACT DESERT RANGER Leucophyllum frutescens 'Compacta'
GREEN CLOUD DESERT RANGER Leucophyllum frutescens
SILVER CLOUD DESERT RANGER Leucophyllum candicans
MEXICAN SAGE *Salvia mexicana*
CURVELEAF YUCCA *Yucca recurvifolia*
FLAT JUNIPER *Juniperus communis* 'Depressa Aurea'

VINES

TRUMPET VINE *Campsis radicans*
CAROLINA JESSAMINE *Gelsemium sempervirens*
PRIMROSE JASMINE *Jasminum mesnyi*
HALL'S HONEYSUCKLE *Lonicera japonica* 'Halliana
CAT CLAW VINE *Macfadyena unguis-cati*
LADY BANKS ROSE *Rosa banksiae*
JAPANESE WISTERIA *Wisteria floribunda*

PERENNIALS

WOOLY YARROW *Achillea tomentosa*
LILY-OF-THE-NILE *Agapanthus orientalis*
DESERT MARIGOLD *Daileya multiradiata*
CHOCOLATE FLOWER *Berlandiera lyrata*
ZAGREB COREOPSIS *Coreopsis verticillata* 'Zagreb'
PURPLE CONEFLOWER *Echinacaea purpurea*
GREEN EURYOPS DAISY *Euryops pectinatus veridis*
GAURA *Gaura lindheimeri*
GAZANIA *Gazania hybrids*
MAXIMILIAN SUNFLOWER *Helianthus maximiliani*
DAYLILY *Hemerocallis hybrids*
ANGELITA DAISY *Hymenoxys acaulis*
BLUE FLAX *Linum perenne lewisii*
BLACKFOOT DAISY *Melampodium leucanthum*
ROCK PENSTEMON *Renstemon baccharifolius*

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FIRECRACKER PENSTEMON *Penstemon eatonii*
PARRY'S PENSTEMON *Penstemon parryi*
CANYON PENSTEMON IPenstemon pseudospectabilis
SUPERB PENSTEMON *Penstemon superbus*
RUSSIAN SAGE *Perovskia atriplicifolia*
JERUSALEUM SAGE *Phlomis fruticosa*
PAPERFLOWER *Psilostrophe cooperi*
WOOLY PAPERFLOWER *Psilostrophe tagetina*
MEXICAN HAT *Ratibida columnifera*
CLEVELAND CHAPARRAL SAGE *Salvia clevelandii*
AUTUMN SAGE *Salvia greggii*
GLOBE MALLOW *Sphaeralcea ambigua*
SOCIETY GARLIC *Tulbaghia violacea*
RAIN LILY *Zephyranthes candida*
PRAIRIE ZINNIA *Zinnia grandiflora*
MEXICAN BUSH SAGE *Salvia leucantha*
MOSS VERBENA *Verbena pulchella*
DESERT ZINNIA *Zinnia acerosa*

ANNUALS

DESERT SAND VERBENA *Abronia vilosa*
CALIFORNIA POPPY *Eschscholzia californica*
BLANKET FLOWER *Caillardia pulchella*
GOLDFIELDS *Lasthenia giabrata*
RED FLAX *Linum grandiflorum* "Rubrum'
ARROYO LUPINE *Lupinus succulentus*
OWL'S CLOVER *Orthocarpus purpurascens*
DESERT BLUEBELL *Phacelia campanularia*
SWEET WILLIAM CATCHFLY *Silene armeria*
MEXICAN SUNFLOWER *Tithonia rotundifolia*
GOODING VERBENA *Verbena gooddingil*

CACTI

GOLDEN BARREL *Echinocactus grusonii*
ENGELMANN'S HEDGHOG *Echinocereus engelmannli*
COMPASS BARREL *Ferocactus cylindraceus*
BUCKHORN CHOLLA *Opuntia acanthocarpa*
BEAVERTAIL PRICKLY PEAR *Opuntia basilaris*
ENGLEMANN'S PRICKLY PEAR *Opuntia engelmannil*
PURPLE PRICKLY PEAR *Opuntia santa-rita*

SUCCULENTS

AGAVES *Agave species*
DESERT MILKWEED *Asclepias subulata*
YELLOW BULBINE *Bulbine frutescens*
SAGO PALM *Cycas revulata*
GRASS TREE *Dasylirion longissimum*
DESERT SPOON *Dasylirion wheeleri*
OCOTILLO *Fouquieria spendens*
GIANT HESPERALOE *Hesperaloe funifera*
RED HESPERALOE *Hesperaloe parvifolia*
YUCCA *Yucca species*

GRASSES

HYBRID MARATHON FESCUE *Festuca arundinacea*

Sidewalks when combined with proper desert landscaping provide great quality of life for Edwards AFB personnel

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Chapter 4 Civil

This section addresses utility marking and infrastructure systems such as wastewater, water, natural gas, storm drainage and roads. It includes parking, pedestrian circulation and airfield guidance. Soil, subsurface investigation and structural issues are also discussed.

4.1 Location, Tracer Wire and Utility Markers

Below ground utilities including water, wastewater, cable television, electric power, telephone, communication, gas and fuel transmission lines shall be located in readily accessible areas for cleaning and repair. These utilities shall not be placed under paved roads or in heavy traffic areas. Select utility siting with the least interference to other utilities. Coordinate right of way with the appropriate shop and the Base Community Planning office.

Roadways must not be cut to provide a utility trench without specific permission of the BCE. Permission may be granted based on the condition of the existing road surface, but not solely on the basis of cost or convenience.

The location of utility system equipment and components shall be placed in areas where the visual impact is less significant and the item is screened from view. Provide architecturally compatible screens around the items when necessary to block from normal viewing. All visual screens must meet AF AT/FP standards.

Repairs, installation and maintenance of utilities shall be accomplished with materials in compliance with these Base Design Standards. Any disturbance to the surrounding landscape during utility work shall be corrected and the landscape returned to its original condition.

All buried utility systems shall have a metallic tracer wire installed in the utility trench to aid in locating the buried/underground piping. Minimum wire size and material is 12 American Wire Gauge (AWG) copper with minimum 30 mil polyethylene jacket designed specifically for burial. Bare copper wire is not acceptable. Detectable line marking tape is not acceptable. Tracer wires must be clearly identified in design drawings. Material, gauge, surfacing locations and typical details, including connection details must be specified. If the utility itself is to function as the tracer wire (e.g., if metal conducting pipe is used), the designer/contractor shall demonstrate that the piping will meet or exceed the requirements for tracer wire.

The wire must be fastened with some slack, to the utility at approximately 10 foot intervals, using tape or non-metallic ties. The wire must not be spiraled around the pipe or be merely dropped into the trench. A spacer between the wire and the pipe may be necessary, if required by other code. If the tracer wire must be joined below ground, the wire must be joined in a permanent bond (braising, cad welding, or equivalent), the joined area insulated and made water -tight.

Tracer wire must be accessible the beginning and end and at each valve box or similar utility entry point. Slack wire must be provided and coiled within these entry points. Access is desired at least every 500 feet. If this is not possible, the ability to carry the signal across the longer distances must be demonstrated by design. Tracer wire terminations shall be clearly tagged or labeled as end points.

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Utility Markers shall be as inconspicuous as possible and blend into the surrounding environment. Small, low profile markers shall be used. Do not paint pavement to mark buried/ underground utilities.

Water system valve lids shall be painted blue. When in close proximity to a curb, the curb shall be scored and painted blue. Scoring will point to the utility valve box and include a number indicating the number of feet to the valve.

4.2 Wastewater System

The prime contractor shall contact 412 CEG/CENME and the 412 CES Infrastructure Systems Flight, Water and Fuels Maintenance (412 CES/CEOIU) sanitary engineer for updated information on base sanitary systems relevant to the project. Wastewater pipelines shall be constructed with either PVC or high density polyethylene (HDPE) pipe. Covers on all main sewer lines shall have a minimum cover of 48 inches. All laterals shall have a minimum cover of 24 inches. If minimum cover cannot be met, the Edwards AFB PM may approve slurry cover.

Trenching. All trenching shall be compacted at the bottom of the trench to 95 percent of maximum density and to a depth of 12 inches per American Society of Testing Materials standards. All trench fill soil shall be compacted to a minimum of 90 percent of maximum density in 6-inch lifts. Digging/trenching 12 inches or below ground surface will require a Base Civil Engineering AFTC IMT 5926 (digging permit).

Manholes. Manholes must be selected to meet expected vehicle loadings. Confirm aircraft loading weight capacities in airfield installations. In non-airfield traffic areas, highway traffic loading is required at a minimum, including installations in non-paved and unimproved areas. All lids must be imprinted with the utility served; blank lids are not allowed. For installations other than finished surfaces, or where flush mounting is otherwise required, position manholes 6 inches above finish grade to reduce later soil coverage of manhole installation. Risers may be cast-iron emulsion coated adjustable or PVC, minimum 6 inch diameter. Galvanized coated sheet metal risers are not permitted.

Industrial Wastewater Permit Application. Industrial wastewater system construction shall be IAW the Edwards AFB Wastewater Instruction. An Industrial Wastewater Discharge Application must be obtained prior to connecting to the sanitary and/or storm sewer systems.

4.3 Water System

The prime contractor shall contact 412 CES/CEOIU for updated information on Edwards AFB water delivery systems relevant to the project. Do not create dead end piping networks.

Water Line Material/Installation. Metallic indicator tape and tracing wire shall be placed approximately 1 foot above non-metallic piping.

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Application	Size Range (inch)	Material
Water Mains	3 to 20	PVC Class 900 and 905*
Services	3/4 to 2	Copper, PVC, HDPE
Above Ground (for backflow preventers, etc.)	2 to 8	Steel and Cast Iron

*High density polyethylene water pipe mains and services are acceptable for pipe insert applications. All other uses of high density polyethylene for mains and services will be evaluated on a case by case basis.

Water Meters. Water meters shall be provided at all new or renovated buildings. The water meter shall be compatible to existing base-wide EMCS/SCADA system. All water meter installations shall be in an accessible location, whether buried enclosed in a meter box or installed in a mechanical environment, manually readable and within proximity to a conduit for connectivity for meter automation with EMCS/SCADA. Additional EMCS/SCADA requirements are found in Chapter 8.

Fire Flow Testing and Distribution Adequacy Verification. The overall adequacy of the water distribution systems including its ability for fighting fires on base, should be evaluated during the early stages of design. Perform fire flow testing and a hydraulic analysis to determine the impact of the new demand upon the existing network under simulated conditions. The prime contractor shall perform IAW NFPA 291. All flow testing shall be coordinated through 412 CES/CEOIU and witnessed by the Fire Prevention section. Flow testing curve shall includes static, residual and pilot pressures. To obtain satisfactory test results of theoretical calculation of expected flows or rated capacities, sufficient discharge should be achieved to cause a drop in pressure at the residual hydrant of at least 25 percent, or to flow the total demand necessary for fire fighting purposes. Flow test results shall be provided to the 812th Civil Engineer Squadron, Fire and Emergency Services Flight, Operations (812 CES/CEFP).

Backflow Preventers. Backflow preventers shall be installed to Title 17 California Code of Regulations (CCR) and 22 CCR with certified backflow test results upon installation. Backflow preventers shall be installed in mechanical rooms when possible. They shall be wrapped with insulation and taped and painted as specified. Painting shall be IAW base paint standards. On exterior backflow preventers, enclosures or screens shall be installed. Where that is not feasible, evergreen vegetation shall be planted to screen the backflow preventers from view. Fire sprinkler systems will require an aboveground, double check backflow prevention device meeting the California Department of Health Services for installation and method of testing. If placed outside, protect the backflow preventer from freezing. FEBCO® backflow preventers shall be used. Piping to and from the backflow preventer shall be fiberglass insulated with an aluminum jacket. The backflow device shall be protected by an insulated blanket.

All temporary and/or permanent connections to the base potable water system (water mains, fire hydrants, hose-bib connections, etc.) shall be equipped with a backflow device as approved. Contact 412 CES/CEOIU for approval prior to making connections.

Air Release Valves. Air release valves shall be installed away from the heavy traffic areas and in locations to allow easy access and routine maintenance.

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Isolation Valves. Isolation valves shall be provided on all mains, at tee intersections and along extremely long transmission lines to permit repairs without disrupting an entire grid. These may be located below paved surfaces with valve box, preferably out of traffic areas. Isolation gate valves shall be American Water Works Association approved. Valve shall be epoxy coated, lined and have resilient seats and coated discs. Each buried valve shall be installed in a sand bedding and also provide a cathodic protection magnesium anode on each buried valve assembly. Metal valve box lids shall be painted blue.

4.4 Natural Gas System

Typical underground gas mains and service piping material shall be polyethylene and shall meet the American Gas Association (AGA) Plastic Pipe Manual for Gas Service (AGA XR0603). Cathodic protection shall be included on all metallic gas piping, excluding anodeless risers.

Gas Valves, Regulators and Meters. Gas valves shall be marked and located within an accessible location. Markers shall be painted a dark brown color. All below-grade gas valves shall be non-metallic polyethylene with 2 inch square operating nut with flow indicating marks. Risers from the valve to the valve boxes may be cast iron emulsion-coated adjustable type, or PVC pipe risers, minimum size 6 inch diameter. Galvanized coated sheet metal risers are not permitted. Valve box lids shall be painted yellow. Gas Regulators shall be located away from visible sites such as the front of buildings. Locate regulators near buildings and away from designated smoking areas. Gas Meters shall be provided at all new or renovated buildings. All devices must be smart meters connected to the EMCS/SCADA system. They shall be in an accessible location and capable of being read. The meter index can be either the traditional circle reading type or the digital-reading format. The plastic that covers the index shall have a protective hard coating, to promote extended readability of the meter. The meter index will be equipped with a remote volume pulser. The remote volume pulser will provide a contact closure pulse that will be read by the EMCS/SCADA system. The pulser will provide a contact closure of > 300 milliseconds. Each pulse is to represent 1, 10, 100 or 1000 cubic feet of gas.

4.5 Storm Drainage System

Stormwater is collected and transmitted through earthen channels and drainage structures. All curbs and gutters shall be connected to the storm drainage system. These structures direct surface water to either the dry lake bed or stormwater retention ponds. With the exception of the Air Force Research Laboratory (AFRL) area, most development has occurred in low-lying areas along the western perimeter of Rogers Dry Lake. Stormwater runoff reaching these areas requires collection and removal. All stormwater facilities shall be designed to the 100-year re-occurrence interval flood, as defined by the United States Geological Survey.

The stormwater drainage system consists primarily of drainage ditches with some storm water structures in the developed areas. These ditches and storm sewers generally flow west to east and empty into the Rogers Dry Lake, or the stormwater retention ponds east of the Main Base flightline. Stormwater runoff in undeveloped areas flows into the nearest dry lake.

Level terrain often prevents flows from achieving velocities sufficient to keep the channels clear. Additionally, the easily eroded soil in the undeveloped, upstream areas of the base often causes

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drainage channels to fill with silt, leading to flooding. Rogers Dry Lake has bottom elevations only slightly lower than those of the stormwater channels entering it; therefore, flooding must be anticipated.

Areas prone to flooding include Rogers Dry Lake, Rosamond Dry Lake, Mojave Creek, portions of the Military Family Housing area and low-lying areas in the Main Base industrial area.

Permits. Permits may be required for discharges into stormwater drainage and/or for erosion control (particularly for disturbance of one or more acres of soil or less than one acre, but is part of a larger common plan of development that in total disturbs one or more acres). Erosion control shall be incorporated into all construction projects. The prime contractor shall be responsible to prepare all required permit applications and submit them to 412 CEG/CEV for forwarding to the appropriate regulatory authority.

The procedures and controls outlined in the Edwards AFB Storm Water Pollution Prevention Plan (SWPPP) shall be followed to meet the requirements of the Clean Water Act.

4.6 Roads

Roads, road alterations, roadway structures and markings shall be designed IAW the California State Department of Transportation (Caltrans) Design Manual and with Caltrans Standard Plans. Roads and road shoulders shall not be widened any more than they presently are, nor shall habitat be disturbed or destroyed without receiving guidance from 412 CEG/CEV. Create roads parallel to contours whenever possible to reduce erosion, visual impact and grades. Preserve rock outcroppings, natural drainage patterns and vegetation when siting new roads or road alterations.

All roads whose posted speed exceeds 45 mph shall have rumble strips installed on the road shoulder. They must be placed to allow unimpeded shoulder use by bicyclists and be IAW Caltrans Standard Plans.

Roadways must not be cut to provide a utility trench without specific permission of the BCE. The standard is to bore or jack conduits and pipes under roads versus cutting the pavement. Jack and bore is the preferred method for provision of new utility lines under existing pavement. However, consideration will be given to cutting existing pavement and trenching during the building of the project requirements/project programming. A decision to the execution method made during the design phase must also consider project cost impacts, age and condition of existing pavement; mission impacts/cost avoidance, urgency of need, weather and land ownership of areas which border AF property (e.g., School Zone, etc.).

Curbing. Curbing is to be used in every parking lot. While their use may be necessary in certain circumstances, the routine use of wheel stops is not allowed. Design sidewalks along parking lots IAW the most recent Architectural Graphics Standards recommendations to accommodate bumper overhang. Grass will not be planted where car bumpers will overhang, use a mow strip.

All curbed roads, streets and parking lots shall be constructed with two types of curbing. The types of curbing shall be header curbs or Type B roll curbing. Curbing will be replaced by

section as defined by expansion or control joints. Curbing shall be constructed with a single pour with no joint between the curb and gutter. Curb transitions shall feather into the ground at end points. Rural gravel roads shall not have curbing. Header curbs are the standard, and are to be used to define road edges, protect the paving and preserve existing drainage patterns. Roll curbing may be used if required for problem drainage areas.

Erosion Control. Elements such as catch basins, concrete swales and sequestration basins shall be similar in material and form. Do not allow water to drain across asphalt paving. Road berms must have a 3:1 slope or less.

Entry Control Points/Facilities and Inspection Areas. These areas shall be constructed and maintained IAW UFC 4-022-01, *Entry Control Facilities and Access Control Points.* Any below grade devices (such as deployable barriers) shall be positively drained and protected from backwash.

Aprons and Shoulder. Provide aprons at intersections of paved and unpaved roads to match the material of the paved road. Aprons shall extend into the unpaved road no less than 50 feet. Provide mud guards where required. Roads shall have a minimum 8-foot-wide paved shoulder.

Traffic and Directional Signs. All traffic signs shall conform to the California Manual of Uniform Traffic Control Devices (CaMUTCD) except that directional signs shall be white letters on brown reflective sheeting. All traffic control and directional signs must be made of Type III, IV or V High Reflective grade sheeting material. The backs of all signs must be covered with Engineer-Grade brown reflective sheeting. All signs located within the clear zone of roadway must be mounted on frangible poles.

All road pavements shall have centerline and lane divider recessed reflectors at 40 foot intervals. All pavements without curbs and gutters shall have recessed reflectors on the edge of the lane. Provide blue recessed road “frogs” in the pavement at fire hydrants.

Bollards. All bollards shall be metal painted Big Stone Brown when 20 feet or more from any facility. Bollards closer than 20 feet shall match the color of the item they protect. They may also be smooth cast stone with integral color. Two each, 4 inch wide bands of matching color reflective tape shall be installed near the top and mid-height of the bollard. Bollards may not be located in the clear zone of the roadway. If location in the clear zone is unavoidable, they must be protected by guard rails.

Guard Rails. Guard rails shall consist of metal posts, and conform to all Caltrans and the American Association of State Highway Traffic Officials (AASHTO), *Roadside Design Guide, 2011.*

Street Lights. Street lights may be located at intersections, curves and other potentially dangerous areas. Lamp fixtures shall be 100 percent cut-off. Street light posts must be either located outside of the clear zone of the traveled way (as defined by AASHTO) or protected by Caltrans-approved guard rail or energy-absorption system.

Asphalt Cement Concrete (ACC). ACC must utilize polymer-modified 64-28 binder or specifically approved alternative.

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4.7 Parking

Parking lots should be as unobtrusive as possible while providing safe and convenient parking for their users, and shall provide adequate lighting. To minimize parking, combine parking of neighboring facilities. Parking must not exceed the standards of Air Force Manual (AFMAN) 32-1084, *Facility Requirements*, and shall comply with Edwards AFB Instruction 31-218, *Motor Vehicle Traffic Supervision, parking prohibitions.* Facility designs are to consider the use of neighboring, existing, parking lots. Parking lots must meet set-back requirements in accordance with UFC 4-010-01, *DoD Minimum Antiterrorism Standards for Buildings.* Fire lanes must be provided.

Properly sited parking lots should maintain the existing patterns of drainage. Create erosion control structures such as catch basins, culverts natural and concrete swales to channel water to storm sewers or naturally occurring or constructed drainage basins. Consider minimizing the drainage impacts downstream. Use of properly designed permeable concrete systems, especially in the parking stalls of the parking lot itself is encouraged. Provide a minimum of 1 percent slope for all paved surfaces and 2 percent for grass lots. The maximum slope allowed for either surface is 5 percent.

Service Access. Provide access to service areas and dumpsters through parking areas when appropriate. Keep service access as distant from the main entrance of the facility as possible. Separated service drives are encouraged. Keep dumpster enclosures at least 33 feet from buildings and provide a 20 foot overhead clearance for trash vehicles. Pads should be at least 6 inches thick.

90-Degree Parking. 10 feet x 18 feet stall parking is preferred. Use of angled, parallel and narrower parking is allowed if required for a specific need or design constraint.

Off-Street Parking. Only off-street parking areas shall be counted towards meeting facility requirements. When calculating parking requirements include all parking within 300 feet of facility entrances unless normal pedestrian traffic is prevented by fencing, lack of hardscape path or other natural obstacle. When performing this calculation, the needs of adjacent buildings must be determined and included.

Reserved Parking. All reserved parking shall have the word "RESERVED" painted on the pavement.

Motorcycle, Bicycle and Oversized Parking. Designate adequate space for motorcycle and bicycle parking near building entrances within the vehicle parking lots. Provide a system for securing bicycles at all parking areas to encourage their use while protecting them from vehicles. Concrete paved parking is required for motorcycle and bicycle parking. Asphalt pavement is not allowed. Specially assigned areas for oversized vehicles will be provided if there is a need.

ADA Parking Provision. Handicapped parking spaces shall match the Uniform Federal Accessibility Standards and comply with ADA requirements. ADA spaces shall be marked by standard (blue) lot markings and CaMUTCD-compliant signage.

ACC. ACC must utilize polymer-modified 64-28 binder or specifically approved alternative.

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4.8 Pedestrian Circulation

Sidewalks. Walkways that provide direct access to facilities should align with the building and column grid lines. Pavers can be used as sidewalks or entryways, accents or to add aesthetics to open walking areas. Major roads through developed areas should have at least one 7 foot wide walkway on one side of the road. Minor roads should have at least one walkway, 5 foot wide, on one side of the road. When it is necessary to patch a sidewalk, replace entire sections between control joints or expansion joints at same time. When installing buried utilities, drill underneath sidewalks to avoid patching and settling.

Sidewalk thickness shall be no less than 6 inches in any sidewalk section likely to receive vehicular loading, including unauthorized vehicular loading. To minimize grades, site sidewalks and trails parallel to contours whenever possible. The guidelines are intended to promote attractive, safe and easy to maintain pathways and bikeways. Locate all sidewalks above grade level to ensure proper drainage.

Portland Cement Concrete (PCC) is normally used. Asphalt or gravel is not acceptable for sidewalk use. Pavers shall be used in areas such as sidewalks, entryways, shade structures and street crossings. Pavers shall be used for accent and aesthetics value. Pavers shall be brick or brick colored, rectangular, laid in a herringbone pattern and contained by borders.

Curb-Cuts. Curb cuts are required at all driveways, intersections and crosswalks and must be ADA-compliant.

Crosswalks. Crosswalks shall be provided where sidewalks intersect roads. Crosswalks must be marked IAW CaMUTCD guidelines.

Trails, Paths and Bikeways. To minimize grades, sidewalks and trails should parallel contours whenever possible. Promote attractive, safe and easily maintainable pathways and bikeways. Remotely located paths and fitness trails should be paved with asphalt or decomposed granite indigenous to the area, and is of an appropriate diameter for the function and maintenance of the system. Use timber edging to control erosion. Bikeways are to be incorporated with all new facilities and significant parking, roadway and sidewalk projects. Distinguish bicycle lanes incorporated into roads or paved pathways with painted striping or signs; 4 foot wide, one-way lanes or 8 foot wide two-way lanes may be used. Type I bike paths are preferable.

4.9 Aircraft Runways, Taxiways and Ramps

All work accomplished on an active airfield area must be coordinated with 412 CEG/CENPL and the Airfield Management/Base Operation Office. Work must be designed and constructed to meet current DoD, AF and Edwards AFB airfield standards.

All airfield runway, taxiway and ramp design work shall be accomplished by a licensed contractor experienced in airfield construction and maintenance. All airfield construction, repair and maintenance shall be performed IAW the USACE guide specifications and regulations. All airfield runway, taxiway and ramp work must be approved by the BCE or

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designated representatives.

ACC. ACC must utilize polymer-modified 64-28 binder or specifically approved alternative. No Reclaimed Asphalt Pavement (RAP) may be used in Airfield pavements.

4.10 Soil and Subsurface Investigation

The prime contractor shall be responsible to perform all soil borings and investigations as required. Edwards AFB will provide existing bore and investigative results if available, upon request..

Fill Soil Standards. Imported fill material shall be free of large rocks, chunks of concrete, organic material and contaminants such as oil, grease, solvents or other hazardous substances.

The use of fill material from an on-base borrow pit, shall come from an approved borrow site as described in the Environmental Assessment for Borrow Sites at Edwards AFB, California (USACE and AFTC 1996). A desert tortoise pre-survey is required at least 48 hours prior to activity commencing at an on-base borrow pit. Fill material from an off-base borrow source shall be obtained from a state-licensed borrow area that has appropriate environmental clearances under the California Environmental Quality Act. Fill material from off-base should be certified weed-free to ensure compliance with E.O. 13112.

4.11 Demolition

Surveys checking for asbestos containing materials and lead-based paints shall be completed prior to the start of any demolition. Unused utilities will be capped at proper termination points determined prior to start of demolition. Demolition sites shall be restored to original conditions. Restoration of the natural hydrological conditions of the property shall be accomplished, to the extent practical. Cavities, depressions, etc., shall be filled in. On a case-by-case basis, demolition sites where aesthetics are important, voids shall be filled in and planted or seeded with desert vegetation (See Chapter 3, Landscaping). Revegetation with local natural desert species should be considered and executed per the *Edwards Air Force Base Revegetation Plan* (AFFTC/EM 1994).

National Emission Standards for Hazardous Air Pollutants (NESHAP) notification is required by State and Federal regulation to be submitted to the applicable Air Pollution Control District for all demolitions and for any project disturbing regulated asbestos containing material above the minimum amounts. Per the Edwards AFB Asbestos Management Plan, all NESHAP notifications are required to be submitted to 412 CEG/CEV for review and approval at least five working days prior to submitting to the regulating authority. All projects disturbing any asbestos require at least a courtesy NESHAP notification be submitted to the applicable Air Pollution Control District.

Landfill Use. All construction debris from base construction contracts shall be disposed in certified off-base landfills.

The contractor shall handle, store and manage its solid waste in a manner consistent with Edwards AFB's procedures including transfer of all solid waste generated to an off-base state licensed landfill.

Contractor shall maintain and report records on a quarterly basis to 412 CEG/CEV for all non-hazardous waste and recycling generated as a result of any activities associated with the project. Records will specify total tonnage of solid waste disposed, solid waste diverted/recycled, construction and demolition waste, disposed construction and demolition waste diverted/ recycled, concrete and asphalt disposed, concrete and asphalt diverted/recycled, scrap metal recycled; and equipment reused, sold or donated by nomenclature and quantity. Total disposal costs, and recycling proceeds and costs (to include equipment sales) shall also be reported on a quarterly basis.

The proponent/contractor shall ensure that all solid waste management on this project complies with all AF requirements and with the local Integrated Solid Waste Management Plan.

4.12 Structural

Design Criteria. Design criteria shall be included on the first page of structural drawings for all products. It shall, at a minimum, include the building code (IBC 2015, UFC 3-301 and UFC 3-310-04) used and the following:

- Design Roof Loads
- Design Floor Loads
- Design Wind Speed
- Design Wind Exposure
- Soil Type
- Soil Bearing Assumed or Known and Soil Bearing Test Date if Known

Design Load. Design load is determined by the Building Code (IBC 2015, UFC 3-301-01 and UFC 3-310-04) at the time of design initiation.

Wind Load. All structures shall be designed to withstand a minimum wind speed of 100 mph, 110 mph or 115 mph within a special wind region where unusual geographic conditions occur (per UFC 3-301-01 Table E1).

Seismic Load. Designers may request specific site information to assist in their independent determination of site soil properties prior to design. Some historical information is available from the 412 CES/CEOHS or 412 CEG/CENME office.

Snow Load and Frost Penetration. The minimum ground snow load shall be 5 pounds per square foot. The depth of the frost penetration is 22 inches (per UFC 3-301-01 Table E2).

Shear Wall Design and Construction. Regardless of any code-allowed economies in the application of plywood sheeting, plywood sheathing, if used, shall be installed the full height and length of all non-penetrated wall sections to prevent installation errors.

PCC Minimum Strength Requirement. Unless specifically designated otherwise, PCC compressive strength shall be 3000 pounds per square foot, minimum. All structural slabs shall be engineered by a licensed engineer.

Chapter 5 Mechanical

All mechanical designs shall be IAW the IBC, ICC International Plumbing Code, International Mechanical Code, International Energy Code and all applicable American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) and NFPA Standards, California Title 24 and AF Engineering Technical Letters (ETL's). In addition, all HVAC systems shall comply with Energy Policy Act 05 (EPACT 05) and Executive Order (EO) 13423. Isolation valves shall be provided on all mechanical equipment as applicable. Isolation valves shall also be provided to enhance facility isolation for future maintenance.

All HVAC systems shall be sized IAW ASHRAE 90.1, or the international energy conservation code using the revision accepted by EPACT 05 and EO 13423 at the time of design. HVAC systems shall not be installed with exterior exposed ducting. If required ducting needs to be exposed, it must be painted to match the exterior of the facility (See Chapter 2 for paint specifications).

General system design weather data including summer and winter dry bulb temperatures of 102 and 22 degrees Fahrenheit respectively at the 97 1/2 percent, summer wet bulb temperature of 67 degrees Fahrenheit and bin temperatures as detailed in UFC 3-400-02.

Provide refrigerant recovery IAW Edwards AFB & Environmental Protection Agency (EPA) protocol. Personnel conducting work on refrigeration units as part of this project must be EPA certified for the type of equipment they are to work on. Equipment used to recover or service these units must also be EPA certified.

5.1 Air Conditioning Systems, Chillers and Air Handling Systems

Locate equipment to allow reasonable access for maintenance and repair. Air handling units shall not be located above ceilings or on rooftops unless approved during the design phase by 412 CEG. HVAC equipment greater than 10 tons shall be equipped with soft start systems. HVAC systems that require more than one chiller or boiler shall have a system pump for each unit (i.e., facility requires three chillers, three chilled water pumps shall be provided). Additionally, all chilled water systems are required to have a redundant pump. New chilled water and hot water systems installed shall have supply and return ports for a temporary chiller hook-up in case of an emergency.

Facilities with more than one story in height shall be provided with at least one air handler for each floor. In compliance with the applicable codes, HVAC air intakes shall be located and/or protected IAW the requirements of UFC 4-10-01, *DoD Minimum Antiterrorism Standards for Buildings*, with Change 1. All air conditioners shall comply with Federal standards requiring a minimum efficiency of seasonal energy efficiency ratio (SEER) 13.

Multiple loop chilled water systems are encouraged due to lower overall energy demand being less than single loop type systems. The primary, constant volume and low head inner loop should circulate chilled water that allows for differential pressure to the various coils.

Air-cooled chillers in compliance with California Energy Commission (CEC) Title 24 are encouraged due to lower maintenance cost. Life cycle costs studies should look at energy consumption, initial costs and operating expenses for air versus water-cooled chillers.

Air side economizers shall be provided for air-handling units (AHUs) over 2,500 cubic feet per minute (CFM), and a total cooling capacity over 75,000 British Thermal Units (BTUs) per hour, IAW CEC Title 24 requirements. Water side economizers using cold "free" cooling condenser water during winter or cold evenings, in selected facilities such as data processing centers are encouraged.

Chilled water or ice Thermal Energy Storage systems (TES) are encouraged to reduce expensive peak demand charges on electrical consumption and comply with CEC Title 24 when using air cooled chillers.

Pursuant to EKAPCD Rule 202 provisions (ref. Section III.A), any unit subject to NESHAP or New Source Performance Standards requirements must be permitted by the EKAPCD. Based on recent revisions to the Reciprocating Internal Combustion Engine (RICE) NESHAP all stationary generators are now subject to the regulation regardless of size – this in turn makes them subject to permitting requirements. Permitting is also required (retroactively) for any non-road engine that fails the indicia of portability (i.e. exceeds the 12-month time limit). Specifically, the following units require permits regardless of previous exempt status in local air quality district regulations:

- All emergency and non-emergency RICE
- All new boilers and process heaters except ones used solely to provide space heating or heat for residential units.
- All new hot water heaters greater than 120 gallons and 1.6 MMBTU/hr or more, including on-demand water heaters

Where HVAC units provide air flow in excess of 2,000 CFM, duct smoke detectors shall be provided in both return and supply ducts, installed IAW UFC-3-600-01, NFPA 90A and NFPA 92A. Duct smoke detectors shall be compatible with, and tied into the Edwards AFB standard Fire Alarm Control Panel (FACP). If no FACP exists, automatic local HVAC shutdown must be provided. Duct smoke detectors shall have a test feature, activated by a push button or magnet. Duct smoke detectors shall not be installed in direct exposure to sunlight or extreme heat. If located outside, they must be weatherproof or protected from elements.

Activation of any portion of the fire alarm system, including the duct smoke detectors, shall shut down the HVAC units until the FACP is reset. For all new or modified systems, working plans and calculations must be prepared and submitted for approval by a registered professional mechanical engineer and an appropriately licensed California Contractor.

Manual Plant Emergency Trip (PET) switches shall be installed throughout the building interior as required to quickly shutdown the HVAC system and the outside air intakes. PET Switch labeling and protection shall be similar to a fire alarm activation button or pull station.

Contractor will provide on-site training to PM, customer and 412 CES maintenance personnel. Owner's manuals and technical manuals shall be provided to PM.

5.2 HVAC Fuel

Natural Gas is the preferred fuel for base heating systems, if available for the project site. For a completely new natural gas feed or a modification of the existing feed into a facility, a standard natural gas consumption meter shall be installed. The meter shall be equipped with a digital output compatible with the Edwards AFB EMCS system.

If natural gas is not available, or if the project site is in a remote area of Edwards AFB, propane gas or heat pumps with supplemental electric heating are the alternative heat sources. Use of a passive solar system is encouraged.

5.3 Plumbing

The prime contractor shall provide plumbing designs, including access to valves, backflow prevention devices, etc. for maintenance personnel. Provide proper backflow and cross-connection prevention appropriate for the hazard involved. Copper piping is recommended where feasible. All piping systems shall be marked with identification tape.

5.4 HVAC Controls

Prior to design, the prime contractor shall consult with EMCS/SCADA to obtain and coordinate information on the current systems available and requirements that will permit communications and monitoring to the existing EMCS. Category 5 data cable runs will be installed in the rooms where the power distribution units, air handlers and other environmental equipment are located such that these systems can be monitored by the EMCS. Facilities not currently integrated into the base-wide EMCS/SCADA system undergoing significant HVAC upgrades ($200,000 or more) or large utility system replacements must include full and effective system integration as part of the upgrade or replacement. Additional EMCS requirements are found in Chapter 8, Industrial Control System (ICS).

The new HVAC control system shall be capable of maintaining communications with the central EMCS in Building 3500. The prime contractor shall coordinate with EMCS/SCADA networking specialists to determine how network communications with the control system in the facility can be supported. The design shall include the connection from the HVAC control system to the nearest network communications hub or alternate design as determined by EMCS/SCADA. Electronic control devices shall be installed in all new construction. Each conditioned space shall include a manual override of setbacks when the system is controlled by a central timer.

EMCS. Equipment terminal connections shall be provided for connecting direct digital control (DDC) type and EMCS or future energy monitoring and control or SCADA systems to control panels for air handlers, chillers, boilers, pumps, etc., IAW Tri Service Manual for EMCS, as approved by the Edwards AFB PM in consultation with 412 CES/CEOIC. This shall include remote reset temperature controls, equipment status, etc., but shall not include isolation amplifiers, relays, etc. The system shall provide operator interaction and dynamic process manipulation, including overall system supervision, coordination and control. Reused data shall be obtained from the remote control unit and multiplexers. Remote control units shall

manage all control function within their data transmission media environments. The central control unit shall communicate with the remote control units. The central control unit is located in Building 3500. Additional EMCS requirements are found in Chapter 8, ICS.

System Commissioning, Measurement and Verification. Base PMs and designers are strongly encouraged to include commissioning of new energy related systems to ensure that the systems are installed, calibrated and perform according to the owner's project requirements, basis of design and construction documents. Fundamental commissioning is recommended for HVAC systems up to 50 tons capacity and enhanced commissioning is recommended for HVAC systems of 50 tons capacity or more. Commissioning agents must be certified by a nationally recognized commissioning certifying organization. In order to provide ongoing accountability of facility consumption over time, a Measurement and Verification plan is highly recommended and strongly encouraged for HVAC installations of 50 tons or more.

5.5 Corrosion Control

Provide cathodic protection (CP) per UFC 3-570-06. All CP designs shall be based upon specific field tests made at the construction site. Tests shall include, but are not limited to, soil/ water resistivity, potential of Hydrogen (pH) and chemistry/corrosivity. Design shall be performed or supervised by a National Association of Corrosion Engineers (NACE) accredited corrosion specialist with at least five years of experience.

New or replacement impressed current cathodic protection systems will include a permanent reference electrode junction box at a level accessible without climbing or the use of ladders.

5.6 Water Treatment

On all systems where water is used for either primary or secondary heating or cooling, equipment must be installed for chemical water treatment. This applies to both closed and open -type recirculating systems. The equipment installation shall be based upon specific information obtained at the construction site and be consistent with existing Edwards AFB water treatment methods. Information would include data such as current analysis of Edwards AFB water. All water treatment design must be performed by a NACE accredited corrosion specialist with at least five years of experience. Chemically treated systems shall be isolated from the domestic water supply by proper backflow/back-siphonage/back-pressure prevention devices. NACE Standard RP-01-75 shall be used as a baseline document by the design corrosion engineer and/or corrosion specialist to assure that all pipe and related facilities are protected from internal corrosion.

Proportional feed equipment shall be used for chemical feed. Chemical feed shall utilize one of two methods: (a) Water meter - pulse meter, pulse connection, feeder pump drive, where chemicals are added in relation to water make-up, or (b) solids controller, to control blow down and chemical feed.

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Chapter 6 Fire Protection

Edwards AFB facilities, sites and activities shall be designed, engineered and constructed with a level of fire protection IAW DoD standards that is sufficient to fulfill the requirements of a best-protected class of industrial, and shall be provided protection to achieve "defense-in-depth." When significant modifications to a facility occur, the current version of the fire protection engineering criteria shall apply. Variances from this base standard will require written justification and approval from 812 CES/CEFP in consultation with the base system owner or points of contacts.

812 CES/CEFP shall be consulted during the scoping phase of all projects to determine the construction type and occupancy criteria of facilities, the level of protection necessary for the facilities and the type of fire protection system(s) to be installed. The primary construction document for facilities design and engineering is UFC 3-600-01, *Fire Protection Engineering for Facilities,* and associated ETLs. Facilities Fire Suppression Section and Engineering Department shall be consulted for exterior water utility connections and available fire flow capacities. Facilities Fire Alarm Section and Edwards AFB Information Technology (IT) organization shall be consulted for exterior communications lines connections.

Design Analysis. A fire protection design analysis is required for all designs and must address the fire protection requirements of the project as required (UFC 3-600-01, paragraph 1-4).

Fire Protection Building Design, Engineering and Construction Analysis. The following list of codes and standards will be used in conducting fire protection design analysis. This list is not all inclusive and will be addressed in UFC 3-600-01 along with other Fire Protection and Life Safety Publications.

- ETLs
- UFC 4-010-01, *DoD Minimum Antiterrorism Standard for Buildings*
- NFPA
- IBC
- International Fire Code (IFC)
- Air Force Occupational Safety and Health Standards (AFOSH)
- AFIs
- FM Global Standards

Services and Qualifications of Fire Protection Engineers. Major projects require the services and review of a qualified fire protection engineer. Projects involving design or modification of fire rated construction, fire detection, fire suppression or life safety systems require the services and review of a qualified fire protection engineer. A qualified fire protection engineer is an integral part of the design team and must be involved in every aspect of the design as it relates to fire protection. This includes, but is not limited to, building code analysis, life safety code analysis, design of automatic detection and suppression systems, water supply analysis and a multi-discipline review of the entire project. For the purposes of meeting this requirement, a qualified fire protection engineer is defined as an individual meeting one of the following conditions:

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- A registered Professional Engineer (P.E.) who has passed the fire protection engineering written examination administered by the National Council of Examiners for Engineering and Surveys.
- A registered P.E. in a related engineering discipline with a minimum of 5 years of experience, dedicated to fire protection engineering that can be verified with documentation.

6.1 Fire Protection During Construction

Contract specifications must reference the USACE Manual, Engineering Manual (EM) 385-1-1, (*Safety and Health Requirements Manual)* and NFPA 241, (*Safeguarding Construction, Alteration, and Demolition Operations),* and must contain the requirement that the activity's fire regulations be followed.

6.2 Documentation Approval and Acceptance

812 CES/CEFP, as the authority having jurisdiction, shall be notified prior to installation or alteration of equipment or wiring. Complete information regarding the system or system alterations, including, but not limited to, specifications, shop drawings, battery calculations and notification appliance circuit voltage drop calculations shall be submitted for approval.

Once the fire alarm system has been installed and the contractor has performed all pre-acceptance testing for all devices, the fire alarm system shall require a 7-day period where all zones are in “normal” status prior to starting any acceptance testing. The first test accomplished will be the 48-hour secondary power test required by UFC 3-600-1.

Before requesting final approval of the installation, the contractor shall furnish a written statement stating that the system has been installed IAW approved plans and tested IAW the manufacturer’s specifications and the appropriate NFPA requirements.

The NFPA record of completion form (NFPA 72 Figure 10.12.2.1.1) shall be permitted to be a part of the written statement required by NFPA 72. When more than one contractor has been responsible for the installation, each contractor shall complete the portions of the form for which that contractor had responsibility.

Preparation of Completion Documents. The preparation of the record of completion (NFPA 72 Figure 10.18.2.1.1) shall be the responsibility of the qualified and experienced person described in NFPA 72 paragraph 10.4.2 and shall be IAW NFPA 72 paragraph 10.18.2.1.

Building Construction – Basic Criteria. Conform building construction to fire resistance requirements, allowable floor area, building height limitations and building separation distance requirements of the IBC, except as modified by UFC 3-600-01 and applicable ETL’s.

6.3 Air Handling

Air Handling Equipment shall be designed and installed IAW UFC 3-600-01, paragraph 2-11.

6.4 Partitions

The IBC fire resistance requirements for permanent partitions do not apply to non-bearing partitions. For fire resistance ratings of non-bearing partitions, comply with NFPA 101. Occupancy separation must comply with the "Required Separation of Occupancies" table in the IBC.

6.5 Type of Construction

Follow the requirements of the IBC to determine the permitted types of construction.

Exception: Per UFC 3-600-01, Type V wood roofs may be constructed on buildings of Type I or II construction, provided that they are separated from all other areas of the building by horizontal 2-hour concrete or masonry fire resistant construction. These roofs will not require sprinkler protection but will require draft stops to divide the spaces into areas not exceeding 280 M^2 (3,000 square foot). Provide self-closing and latching access doors of similar construction in the draft stop where there is no other means of access to the area.

6.6 Separation Between Buildings

Use the IBC to determine required separation distances between buildings, except as modified by UFC 3-600-01.

Fire Areas. Conform to the IBC except as modified by UFC 3-600-01. Exceptions for specific occupancies are listed in Chapter 6 of UFC 3-600-01. Note: The AF permits the allowable area to triple in any building when an approved automatic sprinkler system is installed, regardless of building height, atria or substitution for one-hour fire resistant construction.

Building Height Limitations. Conform to the IBC, except as modified by UFC 3-600-01.

6.7 Limiting Interior Fire Spread

Door openings, in fire resistive construction, must be protected IAW NFPA 80, *Fire Doors and Fire Windows*, except as modified by UFC 3-600-01.

Penetrations. The protection of ducts at point of passage through firewalls must be IAW NFPA 90A, *Installation of Air-Conditioning and Ventilating Systems*, and/or NFPA 90B, *Installation of Warm Air Heating and Air-Conditioning Systems*. All other penetrations, such as piping, conduit, and wiring, through firewalls must be protected with a material or system of the same hourly rating that is listed by Underwriters Laboratories (UL) or a Nationally Recognized Testing Laboratory (NRTL).

6.8 Interior Finish

Interior Wall and Ceiling Finish. Wall and ceiling finishes and movable partitions must

conform to the requirements of NFPA 101 for interior finishes. Drop-out ceilings (foam-grid panels) are not authorized.

6.9 Insulation

Use thermal and acoustical insulation with a flame spread rating not higher than 75 and a smoke developed (SD) rating not higher than 150 when tested IAW American Society of Testing Methods E84 (NFPA 255), *Standard Method of Test of Surface Burning Characteristics of Building Materials*. Test cellular plastic insulation in the same densities and thicknesses as the material that will be used in construction applications.

Note: For certain types of insulation installation, the exceptions described in UFC 3-600-01, paragraphs 2-7.2.1 and 2-7.2.2 apply.

Flame Spread - No Smoke Developed Rating Limitation. Flame Spread ratings shall comply with UFC 3-600-01, paragraph 2-7.2.1 and 2-7.2.2.

6.10 Roof Coverings and Roof Deck Assemblies

Roof Covering and Roof Deck Assemblies shall comply with UFC 3-600-01, paragraphs 2-8 and 2-9.

6.11 Fire Department Vehicle Access

Vehicle Access. Fire department vehicles must have unimpeded access to the building for emergency response. Comply with NFPA 1, *Fire Prevention Code*, dimensions for fire lanes and turnarounds. Such access may require fire apparatus to drive over a curb or through the opening of a gate, removal of a bollard provided no more than one person is required to open the gate or remove the bollard. Any locking device controlling vehicle access must be under control of the Fire Department or 24-hour security personnel located at the specific facility.

Aerial Apparatus Access. Provide new facilities four stories or more in height and all-new warehouses with suitable all-weather ground access surface for aerial apparatus on a minimum of two sides of the perimeter of the structure.

Fire Department Connection. Facilities with fire department connections for sprinkler or standpipe systems must be provided with suitable all-weather ground access surface for pumper apparatus within 150 feet of such fire department connections.

6.12 Plastic Pipe and Conduit

Plastic Pipe and Conduit installation shall comply with UFC 3-600-01, paragraph 2-12.

Note: Plastic pipe and conduit must not be installed in exit stair enclosures or in air plenum spaces unless specifically listed for that application.

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6.13 Fire Retardant-Treated (FRT) Plywood

New Construction. Use of FRT plywood in new construction is prohibited, except as permitted by the IBC. FRT plywood must not be used in any part of the roof or roofing system.

Existing Construction. FRT plywood installations should be regularly inspected for structural integrity. Replacement of damaged FRT plywood may require additional fire protection measures if FRT plywood is replaced with more combustible materials.

6.14 Automatic Fire Suppression Systems

Fire Sprinkler Application Requirements. The Fire Prevention section shall determine if an automatic sprinkler or other fire suppression system is required for all facilities based on mission, hazard of contents, value of contents or other criteria. This determination must be included in the contract documents for design services or design-build services. Fire sprinkler design area and hose requirements shall be per the requirements of the following criteria in this order:

- UFC 3-600-01
- NFPA 13, *Standard for the Installation of Sprinkler Systems*
- ETLs

System Designer Requirements. The sprinkler system may be designed and installed by a licensed sprinkler contractor or designed by an Architectural and Engineering (A/E) firm with fire protection expertise and installed by a licensed contractor. The designer of the fire protection systems shall meet one of the requirements below:

- A Registered, Professional Fire Protection Engineer in the State of California.
- An Individual possessing National Institute for Certification in Engineering Technologies (NICET) Automatic Sprinkler Systems Level III certification.
- An Individual possessing NICET Special Hazards Suppression Systems, Level IV certification, IAW the applicable NFPA code.

Backflow Prevention and Cross Connection Control. Backflow Prevention and Cross Connection Control shall comply with UFC 3-600-01, paragraph 3-7.5.

Note: The installation of backflow prevention and cross-connection control must comply with the American Water Works Association Manual M14, *Recommended Practice for Backflow Prevention and Cross Connection Contro*l.

Plans and Calculations. For new systems or modified systems, working plans and calculations must be prepared and submitted for approval by a Registered Professional Fire Protection Engineer or an individual that has obtained NICET Automatic Sprinkler Systems, Level III certification or Special Hazards Suppression Systems, Level IV certification, IAW the applicable NFPA code. Submit the fire extinguishing system construction drawings to the appropriate components designated Registered Professional Fire Protection Engineer.

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Water Flow Testing. Conduct water flow tests to determine available water supply for the water based fire extinguishing systems. The designer (a Registered Professional Fire Protection Engineer or an Engineer experienced in water flow testing) will perform or witness the required flow testing and verify that the test results are accurate. Accepting historical water supply information or similar data without verification is not permitted. Conduct water flow tests prior to the concept design submission. For design-build projects, the preparer of the Request for Proposal may perform and provide water flow testing.

Water for Fire Protection. One or more of the following reliable means shall provide water to an installation for fire protection:

- Multiple connections to looped or gridded public water distribution system(s) arranged so that during any single-point failure, at least 50 percent of the maximum required fire flow demand plus 100 percent of domestic demand can still be supplied to the activity/facility.
- A single connection to a public water distribution system, plus on-site storage that is adequate to supply domestic demand for 24-hours plus the maximum required fire flow demand in the event the connection to the public system is lost.
- One or more on-site sources, such as wells or open bodies of water, with treated water storage capacity adequate to supply domestic demand for 24 hours plus the maximum required fire flow demand.
- For a small, non-mission-essential activity, such as a reserve training center, a single connection to a looped or gridded public water distribution system, capable of providing concurrent domestic and fire flow demands to the facility, is acceptable.

Installation. An experienced Fire Protection Sprinkler System Contractor licensed by the State of California, possessing a C-16 license for the applicable systems lays out, fabricates and installs all types of fire protection systems; including all the equipment associated with these systems, excluding electrical alarm systems, shall install Fire Protection Sprinkler Systems.

Fire Protection Sprinkler Systems shop drawings and submittals must be reviewed and approved by 812 CES/CEFP **PRIOR** to installation of systems.

Contractor Pre-Acceptance Testing. Contractor shall perform a full test of fire protection systems to identify and correct any/all deficiencies prior to scheduling a final acceptance test. Contractor notice to 812 CES/CEFP should be within 10 working days prior to the desired final acceptance test date.

6.15 Class I Standpipe Systems

When required, standpipe systems must be installed IAW NFPA 14, *Installation of Standpipe, Private Hydrant, and Hose Systems* . Exception: Residual pressure requirements specified in NFPA 14 may be omitted for buildings fewer than 45 meters (150 feet) in height where fire department apparatuses are expected to boost pressure in standpipe systems.

Class I Standpipes. Class I standpipe systems must be provided in the stair towers of buildings four stories or more in height. These systems must not include hoses. Class I

Standpipe Systems must also be provided in facilities where it is impracticable to reach major portions of the building with firefighting hose lines extended from the exterior of the building, regardless of building height.

Class II and Class III Standpipes. Class II and Class III standpipes are not permitted.

6.16 Fire Hydrants

Fire hydrants must be UL listed or NRTL and must have two 65 millimeter (2 1/2 inch) hose outlets and one 115m (4-1/2-inch) suction connection with national standard fire hose threads IAW NFPA 24 and NFPA 1963, *Fire Hose Connections*. Wet-barrel or California-type hydrants are preferable in areas where there is no danger of freezing. Dry barrel or traffic-type hydrants must be used in areas where there is a danger of freezing. Hydrants must be aboveground type. If local municipal departments use nonstandard connections, adapters must be made and supplied to engine companies that respond to DoD installation fires. In DoD installations serviced by only local fire departments, hydrant hose threads must meet local requirements.

Hydrants shall be above ground type with a maximum height of 36 inches. Fire hydrants installed on the flightline shall be low-profile type with a maximum height of 18 inches above ground. Blue recessed reflector frogs shall be installed in the street paving on the same side of the street if the hydrant is 2 feet from the center line.

Fire Hydrant installation will be IAW the requirements stated in UFC 3-600-01. Fire hydrants will be “Jones” Wet Barrel Type. Hydrants will have two 2 1/2 inch outlets and one 4 1/2 inch pumper connection with National Standard Fire Hose Threads. Fire hydrants shall be FM approved or UL listed. Fire hydrant submittals shall be provided to this office for review and approval, prior to installation. Fire hydrants on Edwards AFB do not currently use quick disconnect fittings.

Fire hydrant installation shall be installed with an isolation valve between 1 feet and 4 feet of the fire hydrant and include a shear spool at or just above the finished grade. Hydrant bonnet and cap shall be painted to indicate water flow available IAW NFPA 291. The body shall be painted to indicate if they are a potable or non-potable water source. See Chapter 2.1 for paint specifications.

6.17 Aircraft Hangar Fire Protection Detection and Suppression Systems

Aircraft Hangar Fire Detection and Suppression Systems shall be installed IAW the following standards:

- UFC 3-600-01, *Fire Protection Engineering for Facilities*
- UFC 4-211-01, *Aircraft Maintenance Facilities*
- UFC 4-021-01, *Design and O&M, Mass Notification Systems Change 1*
- NFPA 409, *Standard on Aircraft Hangars*

Any system restraining a chemical anti-corrosion agent, Aqueous Film Forming Foam, Propylene Glycol System, or similar processing chemical shall have a reduced pressure principle device installed.

6.18 Fire Alarm Systems

A fire alarm system will be provided. Fire alarm system panel shall be an addressable NOTIFIER panel. The design and installation of the system shall be IAW all current and applicable specifications, NFPA codes and National Electric Code. Software, connecting cables and proprietary equipment, necessary for the maintenance, testing, and reprogramming of the equipment shall be furnished to the 412th CES/CEOFA upon completion of work (per UFGS 28 31 76 Section 1.94).

Circuit designations shall be as follows: Fault conditions shall be designated Style D for initiating devices, Style Z for notification appliances and Style 6 for the signaling line circuit. All circuits shall be designated Class A. Manual pull boxes shall be double action type with NO break glass/plastic bar feature. Manual pull boxes should be operable with the fire alarm panel key, a screwdriver or an Allen wrench. Provide audible/visual evacuation alarms throughout the facility. At least one visual alarm shall be placed in every occupied room in a location that can be seen from all points in that room. Where this cannot be accomplished with a single visual alarm, provide as many devices as necessary to accomplish this requirement.

Only visual alarms shall be placed in restrooms. Restrooms, which include showers, will have both audible visual alarms. Audible devices shall be spaced so they can be clearly heard in any room in the facility with the door closed. Provide an audible/visual device and manual pull box in each boiler/mechanical/electrical room. All wiring for the fire alarm system shall be installed in metallic conduit. Fire alarm, trouble and supervisory condition transmission shall be accomplished by installing a fire transponder compatible with fire alarm and reporting systems being used at Edwards AFB.

Plans and Calculations. System working plans and calculations must be prepared and submitted for approval by a registered professional Fire Protection Engineer or an individual that has obtained NICET, Fire Alarm Systems, Level III certification (minimum) IAW UFC 3-600-1 and NFPA 72. Submit the fire alarm reporting system, fire alarm evacuation system and automatic fire detection system construction drawings to the Fire Prevention Section (812 CES/ CEFP).

Installation. An experienced Fire Detection and Alarm Systems contractor licensed by the State of California, possessing a C-10 license for the applicable systems shall install Fire Protection Detection and Alarm Systems. A C-10 Licensed electrical contractor places, installs, erects or connects any electrical wires, fixtures, appliances, apparatus, raceways, conduits, solar photovoltaic cells or any part thereof, which generate, transmit, transform or utilize electrical energy in any form or for any purpose.

Fire Alarm Systems drawings and submittals must be reviewed and approved by 812 CES/CEFP and 412 CES/CEOFA **PRIOR** to installation of systems.

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6.19 HVAC Duct Fire Detectors

Where HVAC units provide airflow in excess of 2000 CFM, duct detectors shall be provided in both return and supply ducts, installed IAW NFPA 90A and NFPA 92A. These detectors shall be compatible with and tied into the FACP.

Activation of any portion of the fire alarm system, including duct detectors, shall shut down the units until the FACP is reset. Duct detectors shall have a test feature, which is activated by a push button or by a magnet. Duct detectors shall not be placed in direct exposure to sunlight or extreme heat. Duct detectors installed outside must be weatherproof or protected from the elements in an approved manner.

Equipment and Material Installed in Plenums. Combustible material shall not be located within the plenum space. Electrical wiring passing through plenum space, including telephone and communication wiring shall be UL-approved for that type of environment or shall be in metal conduit. Installation of an uninterruptible power supply (UPS) system must have emergency shutdown switch installed in a location approved by the fire department.

6.20 Electronic Equipment Installations

These areas include major automatic data processing areas, communication centers, command and control systems and other mission critical systems. Incidental electronic equipment such as word processing stations, printers and systems, desk top computers, office automation systems, individual data output stations (e.g., printers, etc.), individual computer work stations, telephones, video conference centers, administrative telephone rooms, reproduction equipment and similar equipment, do not require protection under this section.

Requirements. Construct and protect electronic equipment installations IAW NFPA 75, *Protection of Information Technology Equipment,* except as modified by UFC 3-600-01, and UFC 01-18 *Electronic Equipment Installations*.

Automatic Sprinkler Protection. Electronic equipment installations must be located in buildings protected by wet-pipe automatic sprinklers. Provide complete coverage throughout the building including electronic equipment areas. Protect electrical equipment installations by disconnecting the power upon activation of the fire protection system.

Use of a Clean Agent Fire Extinguishing System. Consideration may be given to the use of a supplementary clean agent fire extinguishing system inside the electronic equipment units or a total flooding system for the room and raised floor. Supplementary clean agent fire extinguishing systems will augment the wet-pipe automatic sprinkler system and will not be considered as a substitute. Air sampling and Very Early Smoke Detection devices will be allowed to activate a clean agent fire extinguishing system pending approval from 812 CES/ CEFP. If the Communication Test Support Facility is to be inside the hangar area it must be protected by a suppression system.

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6.21 Requirements for New and Existing Pre-Fabricated and Site-Built Structures in Aircraft Hangars

AF requirements for both new and existing pre-fabricated and site-built structures in aircraft hangars (hereafter referred to as "pre-fab structures").

- All pre-fabricated structures must be of at least one-hour fire rated construction and shall be provided with automatic sprinkler protection. Documentation showing fire rating/fire spread is required to be reviewed by 812 CES/CEFPP prior to installation of any pre-fab structure.

  Exception: Small, one-person, pre-fabricated structures may be installed without automatic sprinkler protection in those hangars that are provided with permanently installed fire suppression systems. This structure must be capable of holding no more than one-desk, and would typically be used to provide a desk for a shift supervisor or a person having a similar function. It is not intended that this exception be used to allow non-sprinklered office space inside of hangars. Non-sprinkler equipped pre-fab structures typically should not exceed 64-ft.sq. interior floor space. Fire detection is not required in these small, one person and pre-fabricated structures. They may be either of non-fire rated (combustible) or fire-rated construction.
- Pre-fabricated structures must be separated from other pre-fabricated structures by a minimum distance of 20 feet. Pre-fabricated structures must be separated from aircraft IAW normal clearance requirements around aircraft, but a minimum distance of 20 feet.
- Activation of the automatic sprinkler system in the pre-fabricated structure shall automatically initiate fire alarm evacuation in the hangar and fire alarm reporting to the fire department.
- These requirements apply to both temporary and permanent pre-fabricated structures. To meet emerging mission requirements, the Base/Installation Fire Chief may temporarily waive these requirements for pre-fabricated structures in hangars for a period not to exceed 180 consecutive days.
- All site built modular office walls shall have a fire resistance rating of at least 1 hour. These walls shall extend from the concrete floor to the roof. All openings in these walls will be automatic-closing or self-closing and will be rated for at least 45 minutes. Masonry construction is recommended for all separation walls.

6.22 Commercial Kitchen Cooking Equipment – Exhaust Systems

Exhaust systems shall be installed IAW NFPA 96, *Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.* Exhaust fans for the cooking equipment shall be hinged and installed with flexible electrical connections that allow the fan to be removed from the base for cleaning of the fan blades and access to the ductwork for cleaning. Provide a switch on the exhaust fan housing which allows the electricity for the fan to be disconnected. Shop drawings of the exhaust system showing all portions of the new duct, construction materials to be used and limits of the hood must be provided to this office for review and approval prior to the actual installation. Safety rail, platform and access ladder for roof must be installed IAW NFPA 96.

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6.23 Fire Extinguishers

Provide fire extinguisher cabinets to meet requirements of NFPA 10, (2013 edition) for travel distance. Fire extinguisher cabinets shall have the following dimensions: at least 23 inches high, 10 inches wide and 8 inches deep. Cabinets shall have a door with a handle for access to the extinguishers. Cabinets, which require glass or plastic to be broken to access the fire extinguisher, are NOT acceptable.

Purchase of fire extinguishers and installation will be included in design, engineering and cost of the project. Coordinate with 812 CES/CEFP for specifications and types of fire extinguishers.

6.24 Means of Egress and Life Safety

Comply with the requirements of UFC 3-600-01 and NFPA 101.

Means of Egress Marking. Mark means of egress IAW NFPA 101. Internally illuminated signs must be LED type, electroluminescence (LEC) or cold cathode type. Incandescent fixtures are not permitted for new installation. Existing incandescent fixtures may remain in use.

Radioluminous exit signs in DoD facilities are not permitted. Photoluminescent exit signs and egress path marking is permitted only where provided with a reliable external illumination (charging) source providing a minimum illumination of 54 lux (5 foot candles) of unfiltered fluorescent light.

Note: External illumination source must be energized at all times during building occupancy. Such lighting must not be controlled by automatic timers, automatic sensors including area occupancy sensors or accessible manual switches. Controls for such lighting must be accessible only to authorized personnel. Photoluminescent signs must only be installed indoors and must not be exposed to direct sunlight, liquid spray or temperatures outside of the range of 50 to 104 degrees Fahrenheit. The legible viewing distance must be limited to 50 feet.

Emergency Lighting. Emergency lights shall be fluorescent light fixtures with emergency battery backup units. Emergency light fixtures shall be marked in a manner that aids in quick identification for maintenance purposes. All emergency lighting shall be installed IAW NFPA 101.

6.25 Mass Notification System (MNS)

During the planning, programming or design phase for facility construction or renovation, install MNS where required by the Fire Prevention Office and Emergency Management IAW UFC 04-021-01, *Design and O&M: Mass Notification Systems.* For specific facility requirements, contact 812 CES/CEFPP at (661) 277-3124.

Chapter 7 Electrical

Electrical work includes, but is not limited to, the design of the following systems: Primary Electrical Distribution Systems, Secondary Electrical Distribution Systems, Lighting Systems, Lightning Protection Systems and Grounding Systems. Electrical designs shall comply with the following:

- AFI 32-1062 *Electrical Power Plants and Generators*
- AFI 32-1063 *Electric Power Systems*
- AFI 32-1064 *Electrical Safe Practices*
- AFI 32-1065 *Grounding Systems*
- ETL 11-9 *Electrical Manhole Entry Work Procedures*
- ETL 99-4 *Fire Protection Engineering Criteria Emergency Lighting and Marking of Exits*
- ETL 13-4 *Standby Generator Design, Maintenance, and Testing Criteria*
- NFPA 70 *National Electrical Code, 2011* (latest editions and all that apply)
- NEMA *National Electrical Manufacturers Association*
- ANSI C2 *National Electrical Safety Code, 2012*
- 10 CFR 435 *Energy Efficiency Standards for New Federal Low-Rise Residential Buildings*
- Army TM 5-811-6 *Electric Power Plant Supply*
- AFPAM 32-1192 *Energy Efficient Motors and Adjustable Speed Drives*
- UFC Series 3-500 *Electrical*
- UFC Series 3-600 *Fire Protection*
- IES Lighting Handbook, 10th Edition
- IEEE, ANSI, and UL Standards, latest editions and all that apply

Please note that compliance with new ETLs, AFIs and Industry Standards not listed above is mandatory.

7.1 Drawings, Specifications and Design Requirements

Electrical drawings shall provide all necessary construction details for proper installation and accurate bidding. Electrical drawings shall include, but not be limited to the following:

- One Line Diagrams showing all switchgear, switchboards, panel boards, enclosed switches, enclosed breakers, transformers, generators, UPS systems, switches, meters, surge arresters, motors, motor controllers, reactors, capacitors, contactors, feeder conduit sizes, feeder conductor sizes, breaker ratings, fuse ratings, and available interrupting current (AIC) ratings (Riser Diagrams may also be included, but are not a substitute)
- Control Diagrams for all motors
- Panel Board Schedules for all new and revised panel boards
- Lighting Schedules listing the salient features of each new luminaire
- New and removed items clearly located and delineated
- Installation and removals shall be shown on separate plan views and/or section views

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- Legend with all symbols used in the design
- List of all abbreviations used
- Wiring Details showing phase, neutral and home run conductors for each circuit
- Hazardous Areas (i.e., Class, Division, and Group per NFPA 70) shall be clearly identified and labeled on the drawings
- Power rating of all motors shall be shown
- Special grounding and isolated grounding details

Electrical specifications shall be based upon the UFGS and shall detail requirements for all electrical materials that will be used during the construction of the designed project. Design requirements shall include the following:

- The electrical engineer responsible for the design shall visit the site and verify existing conditions.
- The electrical designer shall perform load analysis which shall determine the size of the new load and if the existing electrical distribution system is capable of supporting the new load. If the existing electrical distribution system is not capable of supporting the new load, electrical designer shall design required changes to properly support the new electrical load.
- The electrical designer shall perform short circuit analysis to determine the short circuit rating required for all overcurrent protective devices.
- The electrical designer shall perform a coordination study to ensure that the new distribution system is coordinated and will coordinate with the existing distribution system.
- The electrical designer shall perform life cycle cost analysis on major components, and any components requested by the government, to achieve the lowest total system cost.
- The electrical designer shall perform voltage drop calculations on all services, feeders, and on the worst case branch circuits for each panel board and switchboard.
- The electrical designer shall perform lighting calculations for each room and site. Calculations shall be based upon maintained foot-candle intensity and Illumination Engineering Society of North America (IESNA) recommendations.

7.2 Medium Voltage System Requirements

The prime contractor shall coordinate with 412 CES/CEOFE Electrical Engineer for all additions, connections and alterations to any medium voltage source. Transmission Line System (transmission and distribution lines) shall be underground where feasible. If overhead construction is used, the poles must be armless. New medium voltage services shall be connected to a 12,470 volt (V) source unless otherwise agreed to by the 412 CES/CEOFE Electrical Engineer. Some portion of the base has 34.5KV distribution. New connections to existing underground medium voltage system shall be made via a spare way on a four-way 15kV 600 amp (A) sectionalizing switch. If a spare way is not available, design shall include a new pad mounted four-way 15kV 600A sectionalizing switch that is interconnected to an existing loop circuit.

Manhole and Handhole Requirements. New manholes shall include pulling irons opposite all ducts and cable rack supports on all four manhole walls. All new cables in

manholes shall be routed the long way around the manhole to provide slack for future splices. Provide racks as required to properly rack all new cables in manholes. Electrical work in manholes shall conform to ETL 11-9, *Electrical Manhole Entry Work Procedures*. Hand holes and manholes shall be rated to withstand the load based on the application.

Pad-Mount, Substation and Building Service Transformers. Pad-mount transformers shall be dead front, with Off/On switch on the primary side, fluid level indicator and temperature gauge, oil sample and fill valve and shall be located a minimum of 10 feet away from any facility. Transformers shall be copper wound unless approved by the 412 CES/CEOFE Electrical Engineer. New transformers shall be sized with a minimum of 25 percent spare capacity for future load.

Substation Transformers shall be copper wound, automatic load tap changing type with 16 taps above neutral and 16 taps below neutral, mineral or synthetic oil immersed, rated at 12,470V or 34,500V as required, splices and terminations to be separable connections, dead front service transformers. Ensure transformers shall not contain polychlorinated biphenyls (PCBs). A label indicating "No PCB containing fluids" shall be attached to the transformers. Building Service Transformers shall be copper wound, pad mounted outdoor type, mineral or synthetic oil filled, rated at 34.5 kV or 12.47 kV delta primary 480Y/277V, 208Y/120V or 120/240V single phase. Oil stains on any surface around electrical equipment and transformers shall be tested for PCBs, as a spill, in accordance with 40 CFR 761.

Medium Voltage Switches, Relays and Control Conductors. Medium voltage switches shall be pad-mounted outdoor type, vacuum interrupter type and dead front construction. Overcurrent relays shall match existing relays base wide. Relays shall have 5A phase inputs, 5A ground inputs, Type S1 case, 48/125V direct current (DC) power supply and ASCII RS-485 communication protocol. Control Conductors shall terminate in un-insulated ring terminals. Control conductors shall be color coded IAW National Electrical Manufacturers Association (NEMA) WC 30, Method 1. Terminal blocks for control conductors shall have double rows of screw terminals be rated for up to #10 American Wire Gauge (AWG) conductors, be rated 30A minimum, have tin plated terminals and blocks be made of a phenolic compound. Terminal blocks for current transformers shall have shorting blocks and screws. Mercury can be found in switches and all mercury-containing materials are managed as hazardous and universal wastes. The introduction of mercury-containing materials on Edwards AFB should be minimized when possible and substituted with more environmentally friendly products.

Equipment Pads and Switch Ducts. New concrete equipment pads for external pad mounted transformers, switches and other electrical equipment shall have thickened edges. Interior floor mounted transformers, switches and other electrical equipment shall be raised at least 4 inches on a concrete pad for housekeeping purposes. Switch ducts from new 15kV switches shall go to a manhole before going to a transformer or another 15kV switch.

Metering. Electrical meters shall be provided for all facilities. They shall have remote reading and pulse output capability, and be compatible with the Edwards AFB radio frequency system or fiber optics system for connecting to the Edwards AFB EMCS/SCADA system. By-customer subdivision of meters within a facility is required.

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7.3 Low Voltage Systems Requirements

New low voltage conductors shall be copper and those installed below grade shall be type XHHW. Maximum conductor size shall be 500 kcmil. Conductors shall be paralleled as required to comply with this requirement.

Neutral Bus Rating. 208Y/120V or 120/240V Branch Circuit Panel boards shall have 200 percent rated neutral bus.

Nonlinear Load Supply Requirements. Panel boards that supply power to nonlinear loads (electronic equipment affected by electrical noise i.e., computers, printers, fax machines, copiers, etc.) shall also have an isolated ground bus. Do not use shared neutrals for any circuits. Neutrals that are part of a panel board feeder that feeds nonlinear loads shall be oversized to a minimum of one trade size larger than the phase conductors.

Bus Requirements. Panel boards, switchboards and switchgear shall have copper bus. New panel boards and switchboards shall have a minimum of 20 percent spare space for future addition. New panel boards and switchboards shall be balanced to the maximum extent possible. Switchboards and switchgear shall have raised 4 inch concrete pad for housekeeping purposes.

Panel Board Requirement. Panel boards not in sight of the feeder over current protection shall have a main circuit breaker. Panel boards shall have hinged front covers. Panel boards shall have bolt on style circuit breakers. Panel boards shall be recessed mounted as much as possible.

Electrical Rooms. The headroom above electrical equipment in electrical rooms shall be free from plumbing piping (gas, water) and HVAC equipment. Avoid routing gas, water, piping and HVAC duct work through electrical room. Electrical room space shall be climate controlled.

Transformers. All new transformers shall be sized with a minimum of 25 percent spare capacity for future load. New transformers shall have copper windings and new transformers that supply computer loads shall have an electrostatic shield. Single phase transformers may not be banked into three phase transformer banks.

Raceways. Conceal interior raceways. An electrical metallic tubing (EMT) raceway shall be connected to enclosures and other raceways with compression type connectors. Set screw type connectors shall not be used for EMT raceways.

Feeder Sizing. Feeders shall be sized for a maximum 2 percent voltage drop. Branch circuits shall be sized for a maximum 3 percent voltage drop.

Conduit Grounding Requirement. Each conduit shall include a copper equipment grounding conductor sized IAW NFPA 70. Equipment grounding conductors shall be insulated.

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Duct Bury Depth. Ducts installed below grade shall be 2 feet minimum. Ducts installed under pavements shall be concrete encased. All high voltage ducts shall be installed on bedding material and concrete encased regardless of location. Additionally, high voltage ducts shall have a red warning indicator installed 12 inches above the duct.

Device Wiring Requirement. Receptacles and other wiring devices shall be wired with the screw terminal connections, not the push in connections.

7.4 Motors

Motors must meet or exceed Energy Standard 10 CFR 435 to achieve maximum energy conservation. Motors less than 1/2 horsepower (HP) shall be single phase. Motors larger than 1/2 HP shall be poly phase. Provide power factor correction for all motors 7.5 kilo Watt (kW) (10 HP) and larger. Power factor correction shall be to 95 percent at rated load for the motor. Soft start or reduced voltage starting is required for all motors 15 kW (20 HP) or larger.

New motor controllers shall include hand-off-auto switch. New pilot lights shall be a LED type with a replaceable lamp unit. Motor controllers shall be of magnetic, across-the-line type, reduced voltage and current limiting type. Motor control centers shall have disconnect switches, branch circuit overload protection and be controller mounted in a single assembly. Motor control circuits shall not exceed 120 volts to ground. For ground neutral systems, the neutral conductors shall be directly connected to the started coils.

In HVAC and Plumbing designs, variable frequency drives (VFD) shall be used in applications where partial loading occurs. VFDs shall be of 12 pulse design and include a 3 percent line reactor; or VFD's shall include a low pass harmonic filter designed to reduce the total harmonic current distortion to 12 percent or less. Low pass filters shall have the capacitors switched out when the motor is not operating. VFD rated motor cable shall be used for the circuits from the VFD to the motor.

7.5 Service Equipment

Service entrance equipment shall be located in readily accessible spaces to permit the quick disconnect of power in case of emergency. The service entrance location shall be coordinated with the exterior electric system through 412 CES/CEOFE to ensure that electrical service and feeder circuit lengths are as short as practicable. Low voltage service conductors (600 volts or less) shall be installed underground from transformers to service entrance equipment. Services exceeding 600 volts will be limited to large facilities requiring several load centers. The high voltage service conductors shall be installed underground from the transformer to the service entrance equipment. Service equipment capacities shall be adequate for the estimated load plus 10 to 20 percent for future growth. Generally there shall only be one service disconnect for each facility. At each service entrance provide one kWH demand electric meter with remote capability communication which can be connected to the Edwards AFB EMCS/SCADA system.

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7.6 Grounding

Grounding electrodes shall be copper metallic rods not less than 3/4 inches in diameter, 8 feet long and driven into the ground outside the facility. Ground rods may be installed in multiples on a lateral spacing not less than their buried depth. Electrode resistance to ground shall not exceed 25 ohms under normally dry conditions. Communication facilities electrode resistance to ground shall not exceed 5 ohms under normally dry conditions. All grounding type outlets and receptacles shall be grounded by a separate ground conductor. Grounding shall comply with NFPA 70 requirements.

7.7 Wiring Systems and Circuits

Wiring systems shall consist of insulated copper conductors installed in metal raceways, branch circuits shall be rated a minimum of 20 amperes. In designing circuits, the combined voltage drop on feeders and branch circuits shall not exceed 5 percent. Raceway and conduit size shall be IAW the provisions of the National Electric Code. All wiring in transformer rooms shall be in rigid steel conduit wiring troughs or busways. Use of plastic conduit within structures shall be limited to applications below concrete slab-on-grade construction or in highly corrosive nonhazardous locations. Aluminum conduit shall not be buried in concrete. Flexible metal conduit shall be used for permanent connection to large apparatuses and motors where movement may be involved. Flexible metal conduit may also be used for lighting fixture connections above suspended ceilings. All new interior wiring shall be enclosed by the raceway within walls, floors or ceilings.

Exposed wiring or carriers are not allowed. Non-metallic sheathed cable (Romex) is not allowed. Surface mounting may be considered for extreme situations in remodeling projects. Under floor raceway may be used in large administrative areas where an extensive power and communication requirement cannot be adequately served by wall outlets. Busways may be used for feeders and service entrances when they are more economical than equivalent-capacity insulated conductors in raceways. Plug-in busways may be used in industrial or shop areas to serve a multiplicity of power outlets or motors. Cable trays may be used as a support system for multi-conductor type cable such as underground feeder or service entrance, as permitted by NFPA 70. A dedicated circuit shall be provided for all computers and sensitive electronic equipment. System furniture to be installed shall have all work stations prewired.

7.8 Lighting

Providing safe and useable areas for Edwards AFB functions during non-daylight hours requires position well-planned lighting systems at appropriate locations. Well-planned lighting systems which conform to the Edwards AFB lighting system standards shall be provided. Energy efficient fixtures, lamps and systems in general shall be used. Do not exceed 80 percent of the lighting power densities for exterior areas and 50 percent for building facades and landscape features as defined in ANSI/ASHRAE/IES Standard 90.1-2010, *Exterior Lighting Section*, without amendments. To reduce light trespass, adopt site lighting criteria to maintain safe light levels while avoiding off-site lighting and night sky pollution. Use cut-off luminaries and low-angle spotlights. Use 100 percent cut-off lighting on building exteriors. Use of common non-cutoff “wall-pack” units for exterior building lighting is prohibited.

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Illumination Levels. General exterior illumination levels and cut-off fixture requirements shall be provided as determined necessary for the activity zones determined IAW IESNA RP-33 unless an applicable UFC, AF or DoD standard is otherwise specified.

Support Types. Street light fixture poles shall be rated for 110 mph sustained winds. Parking lot light shall be square aluminum housing and dark duranodic bronze finish, rated for 110 mph sustained winds. Lighting fixtures for parking lots shall be shoe box style with aluminum housing and dark duranodic bronze finish. Along pedestrian pathways, lighted bollards shall be used only in a response to specific hazardous conditions. When used, the luminaire must be shielded to prevent glare and allow preservation of night vision. Sports lighting shall be adequate for the function and orientated to prevent glare and light trespass into the surrounding areas. Accent lighting shall be used when it is desirable to highlight architecture, landscaping or site furnishings.

Exit and Emergency Lighting. Exit signs and emergency lighting shall be provided as required by the NFPA 101. Exit signs shall be light emitting diode type with green letters. Emergency lighting shall be provided by integral battery operated, fixed lighting units. Exit and Emergency Lighting shall conform to ETL 99-4.

7.9 Generators

New or modified generators shall have accessible panels and controls for maintenance and repair personnel. If necessary, a ramp or platform meeting the NFPA 101, *Life Safety Code.* All new and replacement generators must be integrated to the Edwards AFB EMCS/SCADA system. New and modified generators will conform to the criteria outlined in ETL 11-21. For new or existing facilities that have a requirement for a standby generator it will include a Manual Transfer Switch (MTS) and quick disconnects which are compatible to existing Edwards AFB quick disconnect system. Additional EMCS requirements are found in Chapter 8, ICS.

Pursuant to EKAPCD Rule 202 provisions (ref. Section III.A), any unit subject to NESHAP or New Source Performance Standards (NSPS) requirements, must be permitted by the EKAPCD. Based on recent revisions to the RICE NESHAP, all stationary generators are now subject to the regulation regardless of size – this in turn makes them subject to permitting requirements. Permitting is also required (retroactively) for any non-road engine that fails the indicia of portability (i.e. exceeds the 12-month time limit).

7.10 Lightning Protection

Lightning protection air terminals and conductors shall be copper unless installed on an aluminum or steel surface.

Lightning protection systems (LPS) will be inspected on each facility after repair actions (including contractor projects) have been completed on or around the LPS. Reference AFI 32-1062 and UFC 575.01.

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7.11 Light Emitting Diode (LED) Lights

LED lighting must conform to the following ETL's:

- ETL 12-15 LED Fixture Design and Installation Criteria for Interior and Exterior Applications

LED obstruction lights are not approved for use on AF installations unless a waiver is approved IN ADVANCE using the AFMC Form 300.

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Chapter 8 Industrial Control Systems (ICS)

ICS on Edwards AFB includes, but is not limited to Electrical Distribution systems, Advanced Meter Reading Systems, Emergency Power Generation System, Gas and Water Metering Systems, Water Distribution Systems, Tertiary Water, HVAC, EMCS/SCADA and Facility Lighting.

The ICS shall provide operator interaction and dynamic process manipulation, including overall system supervision, coordination and control. Reused data shall be obtained from the remote control unit and multiplexers. Remote control units shall manage all control function within their data transmission media environments. The central control unit shall communicate with the remote control units. The central control unit is located in Building 3500.

8.1 Metering Requirements

All new utility and water installations must be metered. Meters must be remotely readable and compatible and connected with the current EMCS/SCADA system. Sub-metering within facilities is required if necessary if required to determine energy and water use across organizational lines or if significant process energy or water use differences exist.

Electrical Medium-Voltage. Square D Circuit Monitor CM4250 or government approved equal for all mains, Square D Power Meter or government approved equal for all feeder applications. Communications is required to all meters using the established Powerlogic network and connected centrally to the SCADA room in Building 3500 via EGX or EGC Modbus/IP adapters.

Electrical Low Voltage and Facility Voltage. Square D Power Meter CM4250 or PM800 (PM820, PM830, or PM850) or government approved equal. Communications is required to all meters using the established Powerlogic network and connected centrally to the SCADA room in Building 3500 via EGX Modbus/IP adapter.

Natural Gas. Pulse based metering is permissible with a pulse width between 10ms and 327ms for use by an existing PLC in the facility such as an Alerton VLC. Pulse frequency must not exceed 100Hz. Pulse meters must be equipped with a government approved totalizer.

Analog meters are preferred with a 4-20ma output. All distribution gas metering will be accomplished using analog signals to an approved or existing PLC and transmitted via SCADA network to the SCADA control facility at Building 3500.

Water. Flow metering will be provided using 4-20ma signal to an approved or existing PLC such as the Alerton VLC.

Water consumption metering may be provided by pulse with a pulse width between 10ms and 327ms to an approved or existing PLC such as the Alerton VLC. Pulse frequency must not exceed 100Hz. Pulse meters must be equipped with a government approved totalizer.

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8.2 Distribution Requirements

Water and Wastewater System. The water distribution system SCADA will be Alerton BACtalk, or a government approved equal. System specification required in design document. All systems must be connected to the existing SCADA network that will connect the installation to the SCADA control center at Building 3500.

Logic DDC or other will provide for water and wastewater distribution automation. Under no circumstance will automated logic reside on a computer platform. Computers are to be used as operating interfaces and recording devices only.

Electrical Distribution. Protective Relays shall be Schweitzer or government approved equal. Units are to be configured with Ethernet ports for connection to the existing SCADA network using Modbus/IP. Transformer Protection will be accomplished with Schweitzer or government approved equal. Units are to be configured with Ethernet ports for connection to the existing SCADA network using Modbus/IP. PLCs are to be Schweitzer or government approved equal. Connectivity must be made to the SCADA network using Modbus/IP. Substation automation and reclosing shall be Schweitzer or government approved equal.

8.3 Emergency Power Generators

New generator installations will include factory installed telemetry via Modbus and/or DNP 3.0. Modified existing generator installations will include equivalent low voltage metering standards referenced above and engine telemetry in Modbus. Emergency generators are subject to NESHAP or NSPS and will require a permit.

The automatic transfer switch (commercial or Emergency) must include control and status of the following:

- Remote control of transfer switch from EMCS/SCADA control center at Building 3500
- Control of timer setting for restoration of commercial power
- Engine oil temperature and pressure
- Engine revolutions per minute
- Engine coolant temperature
- Engine run hours
- Fuel tank level

8.4 HVAC EMCS/SCADA Controls

The new HVAC control system shall be capable of maintaining communications with the central EMCS in Building 3500 via the base-wide area network. The prime contractor shall coordinate with the Edwards AFB networking specialists at the 412th Communications Squadron (412 CS) to ensure that network communications with the control system in the facility can be supported. The design shall include the connection from the HVAC control system to the nearest network communications hub.

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Electronic control devices shall be installed in all new construction. Each conditioned space shall include a manual override of setbacks when the system is controlled by a central timer.

Building Automated Controls (BAC)

Alerton BACtalk, Trane BACnet or government approved equal is required. All installations must be connected to the existing EMCS and network complete with fully functional displays. LONtalk controls are not permitted.

Chillers should be installed with the manufacturer's control system and provide a gateway to the base-wide BACnet EMCS. Chiller pump controls must be controlled by the chiller. The EMCS should only call for the chiller.

8.5 Communications and Commissioning

All installations must be connected to the existing base SCADA network using IP/Ethernet, Modbus/IP or DNP 3. Installations must be provided with displays installed and functional in the current Edwards AFB SCADA front-end. Projects will include all required communications wiring. A communications plan will be approved by ICS Manager(s) prior to project award.

A commissioning plan and schedule will be included in the contractor's proposal. Commissioning will take place between all affected stakeholders; it will be the last phase of the project prior to project completion.

Chapter 9 Environmental

Compliance with Environmental directives is mandatory for all construction and repair projects. The following Acts govern Environmental Management, also known as 412 CEG/ CEV:

- Comprehensive Environmental Response Compensation and Liability Act
- Resource Conservation and Recovery Act
- Clean Water Act and Safe Drinking Water Act
- Clean Air Act
- Endangered Species Act
- Migratory Bird Treaty Act
- Sikes Act
- National Historic Preservation Act
- National Environmental Policy Act
- Defense ERP
- Other Federal, State and Local laws and regulations as applicable

Contact 412 CEG/CEV at (661) 277-1401 for questions or concerns related to this chapter early in the design process. It is imperative for meeting project timelines.

9.1 National Environmental Policy Act (NEPA)

NEPA requires Federal agencies to consider the environmental consequences of proposed actions in the decision making process. The intent of NEPA is to protect, restore or enhance the environment through well-informed Federal decisions. The AF implements NEPA requirements through the Environmental Impact Analysis Process (EIAP), 32 CFR 989. Time frames for completion of the EIAP process are dependent on the significance of potential impacts (ranging from a few weeks to a year or more). Non-compliance with NEPA regulatory requirements may result in court injunction, delay of mission-essential projects and project cost overruns.

EIAP. 412 CEG/CEVA EIAP Section must be contacted early in the design process and the EIAP process completed before project design, approval, funding or Siting Committee review and approval is completed. The EIAP process considers location, construction, and operational issues in regard to compliance with environmental legislation and environmental issues related to air quality, hazardous materials, hazardous wastes, pollution prevention, solid waste, recycling, natural resources, cultural resources, soils and geology, safety, water, flood plains, bird air strike hazard (BASH) and flightline issues.

- The prime contractor and Edwards AFB PM shall work with 412 CEG/CEV staff during the completion of the design and EIAP process to define the environmental compliance requirements for the project. Some of these requirements may affect location, construction or operation of the project, or identify permitting requirements.
- When the EIAP process is complete, the prime contractor or Edwards AFB PM will receive a copy of the environmental document with minimization measures required

(list of environmental compliance requirements) that must be applied during design, construction and operation of the facility to reduce the potential impacts to a level of insignificance.

- The Edwards AFB PM shall be responsible for the actions of its contractors and ensure its contractors understand and comply with the environmental provisions.
- The prime contractor or PM shall cooperate with 412 CEG/CEV in all aspects of Edwards AFB contacts with regulatory agencies regarding project activities.
- Environmental issues that may be identified and requirements that may be imposed are shown below.

9.2 Air Quality

Edwards AFB activities are subject to the Federal and State Clean Air Acts and California Air Resources Board (CARB) rules and regulations. Portions of Edwards AFB are in one of three local air districts which regulate local air pollution activities. Most of Edwards AFB is in the EKAPCD, while small portions are in the AVAQMD or the MDAQMD.

NESHAP notification (asbestos and /or demolition) is required by regulation to be submitted to the applicable Air Pollution Control District (typically EKAPCD Rule 306 and Rule 423, and Federal 40 CFR Part 61 Subpart M) for ALL DEMOLITIONS and for ANY PROJECT (demolition or renovation) disturbing regulated asbestos containing material (RACM) above the applicable district's de minimus amounts. Per the Edwards AFB Asbestos Management Plan (AMP), all NESHAP notifications are required to be submitted to 412 CEG/CEV (Toxics/ Asbestos Department) for review and approval at least five (5) working days prior to submitting to the regulating authority, which will then have a ten (10) day waiting period, as applicable. Prior to starting, per the AMP, all projects disturbing any amount of asbestos containing material require at least a Courtesy NESHAP notification be submitted to the applicable Air Pollution Control District (EKAPCD, AVAQMD, MDAQMD) and 412 CEG/CEV Toxics/ Asbestos Department.

Air Emission Permits. The prime contractor shall provide advance notice of any changes in operations or conditions (through the Edwards AFB PM) that might result in increased air emissions in sufficient time to allow 412 CEG/CEV to obtain any necessary permits or permit modifications and required plans.

Permits could include an EKAPCD, AVAQMD or MDAQMD Authority to Construct/Permit to Operate and a Title V Federal Operating Permit to be filed with that air district. Project activities must also comply with Clean Air Act Title III hazardous air pollutant requirements for stationary sources.

The prime contractor shall be responsible for providing all information to obtain, maintain or renew permit applications including any attachments or supporting documents required. The prime contractor will not commence any activities until the appropriate permit is formally approved (e.g. construction). Permit applications shall be processed through the regulatory agency by 412 CEG/CEV and all contacts with a regulatory agency will be conducted only by 412 CEG/CEV.

Construction/remodeling/demolition/operational activities that may require an air permit include, but are not limited to:

- Boilers/Steam Generators. New boilers/steam generators greater than or equal to 5 million BTUs) per hour (natural gas/LPG - requirement varies for other fuels).
- Internal Combustion Engine. Based on recent revisions to the RICE NESHAP criteria, all stationary generators are now subject to the regulation regardless of size – this in turn makes them subject to permitting requirements. Permitting is also required for any non-road engine that fails portability criteria by remaining at a fixed location for more than 12 consecutive months and/or by not possessing attributes such as, but not limited to, wheels, skids, carrying handles, a dolly, trailer or platform.
- Pursuant to EKAPCD Rule 202 provisions (ref. Section III.A), any unit subject to NESHAP or NSPS requirements must be permitted by the EKAPCD. However, for stationary engines less than 50Hp, as of Jan 2017 EKAPCD has used its discretion and does not require permits.
- Prior to final equipment selection/procurement, specifications for any item subject to air quality standards shall be submitted through the project manager to 412 CEG/ CEVC for review and acceptance.

Pollution Prevention. The prime contractor shall be responsible for meeting the following pollution prevention requirements:

- Notifying 412 CEG/CEV to obtain approvals prior to all new construction, modified or decommissioned pollution sources or regulated activities on the installation.
- Immediately notifying 412 CEG/CEV of any project related activity that may constitute a permit violation and providing an action plan for returning to and staying in compliance.
- The proposed project shall use diesel fuel meeting CARB specifications.
- All project-required emission sources (i.e., boilers, generators, tanks) that require modification must be reevaluated before any work can begin.
- The proposed project shall not exceed visible emission limitations as outlined by the local air district.
- All chemicals/materials procured for a project by any means other than the Hazmat Pharmacy shall be reported to 412 CEG/CEV at (661) 277-9213 or (661) 277-1401.

The proposed project shall not discharge from any source, whatsoever, such quantities of air contaminants or other material that would cause injury, detriment, nuisance or annoyance to any considerable number of persons or to the public or which endanger the comfort, repose, health, or safety of any such persons or the public or which cause or have a natural tendency to cause injury or damage to business or property.

Personnel conducting work on refrigeration units as part of this project must be EPA certified for the type of equipment they are to work on. Equipment used to recover or service these units must also be EPA certified.

Fugitive Dust Minimization & Mitigation Requirements. The following fugitive dust minimization measures are applicable to unpaved roads, construction and demolitions activities, earth moving, open storage piles and grinding equipment:

- Maintain speed limits on unpaved roads on base between 5 and 35 mph.
- Suspend grading, disking, grinding operations and other earthwork projects at wind speeds exceeding 25 mph.
- Water roads and open areas upon which work is performed along with operating grinding equipment in order to suppress dust. If winds produce visible dust, erect wind barriers.
- All vehicles hauling bulk materials or debris shall be covered. Regulated material shall be handled IAW applicable State and Federal regulations.

Ground-disturbing activities shall reduce dust emissions by performing the following:

- All earthwork activities shall be planned and conducted to minimize the duration that soils would be left unprotected. The extent of the area of disturbance necessary to accomplish the project shall be minimized. Exposed surfaces shall be periodically sprayed with water
- Compact ground by rolling
- Revegetate or otherwise stabilize soils
- Restore roads and other areas by revegetation when the area is no longer needed for base operations

Air Conformity Reporting Requirements. The prime contractor or Edwards AFB PM will provide to 412 CEG/CEV, in advance, any information that relates to project activities that might have an impact upon the installation's Clean Air Act conformity status.

9.3 Solid Waste

Solid Waste Disposal. The project contractor shall be responsible for transporting solid waste to an off-base State-licensed solid waste facility. The customer shall maintain and report records on a quarterly basis to 412 CEG/CEV for all non-hazardous waste and recycling generated as a result of any activities associated with the project. Records will specify total tonnages of solid waste disposed, solid waste diverted/recycled, construction and demolition waste disposed, construction and demolition waste diverted/recycled, concrete and asphalt disposed, concrete and asphalt diverted/recycled, scrap metal recycled; and equipment reused, sold, or donated by nomenclature and quantity. Total disposal costs, and recycling proceeds and costs (to include equipment sales) shall also be reported on a quarterly basis.

The contractor shall furnish the following information to the Contracting Officer:

- Name and address of the proposed landfill to be used for disposal or project related waste
- Landfill class

- Proposed materials to be disposed of at this location

This information is to be submitted for all materials to be disposed of by the contractor, including hazardous waste as well as demolition debris, and will be submitted and approved before construction work begins.

The prime contractor shall comply with all Edwards AFB policies and procedures for waste minimization to include segregation of recyclable materials and coordination with the Edwards AFB recycling center for proper disposal.

Inert debris such as concrete, asphalt, ceramics, etc. (does not include wood or drywall) from renovation, demolition, construction projects shall be crushed/processed by the project contractor and stockpiled for reuse at the appropriate inert debris area. It will not be disposed of as waste.

All applicable lead based or lead containing paint (loose and peeling paint) and any asbestos materials must be removed first and properly disposed of IAW applicable rules and regulations.

Construction projects (new and demolition) will recycle to the maximum extent possible. The contractor is responsible for developing a recycling/diversion plan and implementing a recycling/reuse effort to divert excess material during project activities. This plan needs to be submitted to the Integrated Solid Waste Manager for review prior to contract accomplishment. Examples of materials to be recycled during new construction include cardboard from materials being installed, wood, metals, etc. Materials to be reused during demolition include concrete, asphalt, metal ducting, wood, cabinets, doors, etc. Recycled/processed concrete and asphalt (inert material) should be used in projects such as, but not limited to, road and parking construction. Consider using crushed concrete from Edwards AFB stockpile areas for road shoulder stabilization. Recyclable material should be source separated for easy recycling.

Recycling Containers. Recycling areas/containers will be incorporated into all new buildings, Edwards AFB common areas and parks designs for both interior and exterior use. Containers will fit with the decor of the facility and should be appropriate for the use expected (may be dumpster or smaller [airport type] containers). The containers will be located within high traffic areas and shall be designed to be aesthetically pleasing. Recycling receptacles that are larger and more convenient than trash containers are encouraged.

Concrete Rinsate Disposal. The proponent/contractor shall be responsible for collection and disposal of inert debris to include waste concrete, asphalt and concrete rinsate generated from project activities and shall be collected in a designated area within the project work site. At project completion, inert debris must be removed from project site, concrete rinsate must be dry and disposal of waste will be in an approved Edwards AFB inert debris location or off base landfill.

Solid Waste Disposal Minimization. Contractor shall be responsible for presenting a plan to the Edwards AFB PM and the Integrated Solid Waste Manager for approval detailing how they will address both inert material (concrete, asphalt, etc.) and construction and demolition debris. Contractor shall be responsible for implementing this plan and striving for a maximum diversion rate of their solid waste stream.

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9.4 Hazardous Waste

All hazardous waste management shall comply with all applicable sections of AFI 32-7042, *Waste Management* (November 2014); the Edwards AFB Hazardous Waste Management Plan (July 2014); 40 CFR 260-299, *Storage, Treatment, and Disposal of Waste*; and 49 CFR 171-185, *Waste Transportation and Packaging*. Any hazardous wastes generated at Edwards AFB must be properly managed. This may include manifesting to an EPA permitted treatment, storage and disposal facility, transporting by an EPA approved waste hauler and being properly treated prior to any land disposal. Treated construction wood, treated railroad ties, out-of-service utility poles and painted construction wood materials are considered to be hazardous waste until tested or proven by the contractor's knowledge to be non-hazardous.

The prime contractor or PM must handle, store and otherwise manage the project hazardous wastes in a manner consistent with installation procedures and notify 412 CEG/CENMP of the types and amounts of hazardous wastes it is likely to generate. This must occur in a timely manner to ensure expeditious handling and disposal of such wastes.

Copies of Safety Data Sheets (SDSs) and inventories of hazardous wastes that were disposed of during the course of the contract must be provided to the Environmental Management Hazardous Material and Waste Program at the conclusion of the contract. The closeout submittal must contain all information required by the initial submittal.

Land Disposal Restrictions. Hazardous wastes are subject to land disposal restriction requirements. Signed hazardous waste disposal manifests and appropriate shipping papers shall be required for all hazardous waste that may be generated on this project to include asbestos containing materials; lead, mercury, chromium, other heavy metal-based paints; and/or Polychlorinated Biphenyl (PCB) containing wastes prior to transportation for off-site disposal to an EPA-approved landfill. The proponent/contractor shall submit all manifests to 412 CEG/CEV for signature.

The proponent/contractor shall submit all facility waste profile sheets, manifests and land disposal restrictions for signature to the Environmental Management Hazardous Material and Waste Program or a properly trained person with Delegation of Signature Authority by the 412th Test Wing Commander.

9.5 Hazardous Materials

Edwards AFB must maintain accountability and control of all hazardous materials (HM) on the installation. 412 CEG/CEV is responsible for controlling all HM IAW the Edwards AFB Hazardous Materials Management Plan and Edwards AFB Instruction (EAFBI) 32-119, *Hazardous Material Management Program (HMMP).* This instruction is applicable to all organizations on Edwards AFB, including tenants and contractors. Any questions regarding this instruction and regulatory requirements should be directed to 412 CEG/CEV and all applicable report requests should be provided to 412 CEG/CEV in a timely manner.

The proponent/contractor shall comply with, and participate in, Edwards AFB HMMP, including pharmacy, pollution prevention and solid waste programs. 412 CEG/CEV will provide all information necessary to assist the prime contractor in determining storage, disposal

and recycling requirements of any hazardous/non-hazardous materials. Contractors remain responsible for all air quality emissions sources brought onto Edwards AFB up to and including securing air quality permits for relevant equipment prior to introduction onto Edwards AFB.

HM Authorization and Management. The proponent/contractor shall ensure all HMs (e.g., solvents, paints, glues, adhesives, etc.) are authorized and managed in compliance with applicable sections of the HMMP.

HM Accounting. Project design shall take into account the types of HMs to be used, the wastes that may be generated and the recycling requirements for empty containers.

Non-Hazmat Pharmacy-Obtained HM Reporting Requirements. Project personnel shall report all chemicals/materials they procure for this project by any means other than the Hazmat Pharmacy to 412 CEG/CEV. Contact 412 CEG/CEV to ensure that these chemicals/materials are included in the Edwards AFB emission reports to meet the HM inventory requirements.

Spill Response Plans. Provide 412 CEG/CEV with a current site-specific spill response plan, as required. Immediately report any hazardous waste or HM releases (spills) to the installation emergency response activity, and fully cooperate with any emergency response IAW 412 CEG/CEV plans and directives.

Propellant Use or Production. If projects will use or produce propellants which are potentially dangerous to personnel, contact AFRL/PROF at (661) 275-5135 regarding the safety concerns involved with this project.

Used Oil and Waste Liquid Petroleum Products Management. The Used Oil program encompasses the management of used oil and waste liquid petroleum products. Included under this program are off specification fuels (Avgas, Mogas, Jet, etc.) and spent non-halogenated petroleum solvents. When accumulating used oil/waste liquid petroleum products, the generator must comply with 412 CEG/CEVC Hazardous Waste Management Plan (July 2014).

HM Within Piping Systems. Identify and characterize HM that may be present inside piping systems to avoid potential overexposure to workers and to ensure that the proper personal protective equipment is used during project activities. Contact Bioenvironmental Engineering for specific requirements.

Storage Tank Permit Requirements. Contact 412 CEG/CEV for permit requirements for UST and AST installations, alterations or changes in service or temporary or permanent closure (either removal or abandonment in place).

New and existing USTs and ASTs shall comply with the requirements in Edwards AFB's Spill Prevention Control and Countermeasure plan and Kern County Environmental Health Services Permit requirements.

AF policy establishes that secondary containment for USTs and ASTs (either a vault or double wall with interstitial monitoring) shall be mandatory. This policy also recommends the use of suction piping with an aboveground pump and minimized piping runs.

All aboveground tanks must be double-walled or have secondary containment of sufficient capacity to hold the greater of either (1) 110 percent of the volume of the largest tank or (2) the volume of the largest tank plus sufficient freeboard to contain precipitation (a 24-hour 25 year storm event - 3 inches).

All project designs involving any actions with UST's or AST's shall be coordinated through the 412 CEG/CEV Storage Tank Program Manager (STPM) to ensure all UST/AST regulatory concerns are addressed. The STPM will provide permitting requirements and be the sole communicator with the county regulatory authority.

All tanks less than 7.57m^3 cubic meters (2000 gallons) shall be designed as aboveground, vaulted tanks unless prevented by site-specific conditions. Justification for installing underground storage tanks must be sent to Headquarters AFMC/CE for approval.

Storage tank installation and removal permits, work plans and closure reports may be required. Contact the 412 CEG/CEV STPM for exact requirements.

9.6 Water, Floodplains, Wastewater and Storm Water

Permits may be required for activities that involved wastewater and storm water (industrial and construction activities) discharges to the Edwards AFB sewer system or to ground surfaces (including the desert surface). The contactor may also be responsible for preparing a site specific storm water pollution prevention plan and the payment of appropriate permit fees per State Water Resources Control Boards and Lahontan Regional Water Quality Control Board requirements. The 412 CEG/CEV Water Program Manager will provide permitting requirements and be the sole communicator with the appropriate regulatory authority.

Executive Order (EO) 11988, Floodplain Management, May 24, 1977 requires all federal agencies to provide leadership and take actin to reduce the risk of flood loss, minimize the impacts of floods on human safety, health, and welfare, and restore and preserve the natural and beneficial values of floodplains when acquiring, managing, or disposing of federal lands. If the only practicable alternative requires siting in a floodplain, before taking action, the Air Force is required to design or modify its action in order to minimize potential harm to or within the floodplain, and prepare and circulate a notice containing an explanation of whey the action is proposed to be located in the floodplain. Contact 412 CEG/CEVA for specific guidance.

All temporary and/or permanent connections to the Edwards AFB potable water system (water mains, fire hydrants, hose-bib connections, etc.) shall be equipped with a backflow device as approved by the BCE.

Project shall be designed in compliance with all applicable Federal, State, county and municipal environmental laws and regulations, as well as any applicable existing permits and administrative orders. Design standards and permit requirements shall be identified in the concept design phase. Where designs include the installation of backflow prevention devices, the units must be California EPA approved and they must be installed no higher than 1.5 meters (5 feet) above the floor. The designer shall complete all permit applications and shall submit the applications with any necessary supporting documents, including pertinent construction

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drawings and specification sections to 412 CEG/CEV for review and processing on to the regulatory authority.

The overall design objective for each project is to maintain predevelopment hydrology and prevent any net increase in storm water runoff. DoD defines "predevelopment hydrology" as the pre-project hydrologic conditions of temperature, rate, volume, and duration of storm water flow from the project site. The analysis of the predevelopment hydrology must include site-specific factors (such as soil type, ground cover, and ground slope) and use modeling or other recognized tools to establish the design objective for the water volume to be managed from the project site.

Section 438 requirements of the Energy Independence and Security Act (EISA) for construction of facilities with a footprint greater than 5,000 gross square feet, or expansion of the footprint of existing facilities by more than 5,000 gross square feet shall be followed. Estimated design and construction costs for implementing EISA Section 438 shall be documented in the project cost estimate as a separate line item. Final implementation costs will be documented as part of the project historical file. Post-construction analysis shall also be conducted to validate the effectiveness of as-built storm water features.

Industrial SWPPP Compliance. The Best Management Practices and controls outlined in the Edwards AFB SWPPP shall be followed as practicable to protect waters of the state. If disturbing one or more acres of land or less than one acre, but is part of a larger common plan of development that in total disturbs one or more acres, per AFI 32-7041, *Water Quality Compliance*, the proponent/contractor shall prepare and submit a SWPPP to include site-specific control measures and best management practices that would be implemented during construction activities. This plan shall be reviewed by 412 CEG/CEV for approval prior to the implementation of the plan. The procedures and controls outlined in the SWPPP shall be followed to meet the requirements of the Clean Water Act.

Septic Tank Requirements. Septic tank system installations shall follow Uniform Plumbing Codes and meet the "Criteria for Individual Waste Disposal Systems" as outlined in the Lahontan Basin Plan.

Well Abandonment. If the project involves well abandonment a permit must be obtained from Kern County, Los Angeles County or San Bernardino County. Project proponent must also comply with the California Department of Water Resources Water Well Standards.

9.7 Special Considerations

Precision Impact Range Area (PIRA). Projects located in the PIRA must coordinate project activities with Range Ground Operations. Due to the type of operations conducted on and within the PIRA, there is a potential to encounter live and non-expended ordnance. If material suspected to be hazardous is found during project activities, the proponent/contractor shall notify Range Ground Operations at (661) 275-5603.

Flightline. New construction, renovation or demolition in proximity to the flightline may increase the potential for foreign objects on taxiways or runways used by aircraft. The proponent/contractor shall contact Airfield Management (412 OSS/OSAM) at (661) 277-3808

for Foreign Object Damage reduction measures. A 10 to 14-day advance notice with 412 OSS/OSAM is required for any activity within flightline boundaries.

New construction, renovation or demolition in proximity to the flightline may require an airfield construction waiver and/or a free zone. Contact 412 OSS/OSAM and 412 CEG/CEN for information regarding airfield waivers and 412 SFS/S3 for information regarding free zone requirements. Allow sufficient time for processing waivers and free zone requests prior to starting work on site.

Major noise sources on the flightline are from aircraft and helicopter operations, engine testing, and the operation of powered tactical support equipment. As such, workers along the flightline may be exposed to increased noise levels that may be above acceptable levels established by AFOSH and Federal and State OSHA regulations. The contractor shall be responsible for implementing OSHA hearing protection measures for their employees. Where Federal employees are involved in project work, contact Bioenvironmental Engineering (412 AMDS/ SGPB) at (661) 277-3272 for specific requirements.

Confined spaces as defined from Occupational Safety and Health Standards, Subpart J, General Environmental Controls, Permit-Required Confined Spaces, OSHA Standards—29 Code of Federal Regulations (CFR), standard number: 1910.146 (reference 2) is a size and shape to allow a person to enter; limited openings for workers to enter and exit; and not designed for continuous occupancy. Confined spaces are classified as two types—permit-required and non-permit. Permit-required confined spaces are defined as having one or more of the following characteristics: contains or has potential to contain a hazardous atmosphere; contains a material with a potential to engulf an entrant; and internal configuration that could trap an entrant or asphyxiate by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section; and contains any other recognized serious safety or health hazard. Non-permit confined space means a confined space that does not contain or, with respect to atmospheric hazards, have the potential to contain any hazard capable of causing death or serious physical harm.

BASH Requirements. If aspects of project activities may increase the potential for bird strikes on aircraft in flight, the proponent/contractor shall follow AFI 91-202, *The U.S. Air Force Mishap Prevention Program*, for overall program elements and AF Regulation 127-15, *BASH Reduction Program*, for actual bird avoidance techniques. The proponent/contractor shall contact Flight Safety (412 TW/SEF) at (661) 277-2623 for Edwards AFB-specific BASH information.

All trash shall be contained within raven-proof (covered) containers and removed from the project site. Avoid creating ponding water in or near project area, so that it minimizes the attraction of wildlife, such as desert tortoise and birds and create collision hazards or increase the potential for accidental takes. Limit bird roosting and nesting habitat (such as ledges and protrusions) on new construction near the flightline. In addition, ensure roofing, especially hangars, does not have openings that would allow birds to enter and nest. Consider usage of screening or anti-perching devices for new or retrofit construction projects.

Hazardous Waste/Hazardous Materials. No PCB or PCB containing equipment (to include lighting) is to be used in construction or renovations. Labels indicating “No PCBs” will be on all electrical equipment, such as voltage regulators, switches, transformers, etc., to

indicate their content.

Asbestos containing materials and lead based paint. Facilities on Edwards AFB are known to contain asbestos containing materials and/or lead-based paint. The Asbestos Notification Act requires building occupants be notified of the presence of asbestos. Prior to any facility impact, contact the Asbestos and Lead Operations Officer for information regarding previous surveys and to assure concerns are identified and addressed.

- Asbestos abatement activities shall be designed IAW Section 02080 General Asbestos Specifications and the Edwards AFB AMP (February 2015), and the Edwards AFB Asbestos Operating Plan, Appendix C of the AMP
- Projects impacting lead containing materials shall be completed IAW Section 02090 *Lead in Paint Specification* and the Edwards AFB Lead Based Paint Management Plan, dated March 2014

All materials used in renovations and new construction will be certified asbestos and lead free (SDSs will be provided to the 412 CEG/CEVC Asbestos Section for inclusion in asbestos/lead database). There are many building materials that still contain asbestos so care in ensuring these are not used must be taken. Potential asbestos containing materials include but are not limited to: joint compound, floor tile, floor tile mastics, roofing mastics, transit piping, etc.

Mercury-containing materials are managed as hazardous and universal wastes. Mercury can be found in high-intensity discharge lamps, fluorescent lamps, mercury vapor lamps, switches, thermostats, etc. The introduction of mercury-containing materials on Edwards AFB should be minimized when possible and substituted with more environmentally friendly products.

For information on the proper packaging, storage, and shipping of universal wastes contact the Consolidation, Recycling, and Universal Waste Facility via 412 CEG/CEV. The proponent/ contractor shall contact 412 CEG/CEVC for abatement/removal requirements.

PCB. Electrical fixtures/ballasts/oil-filled cables scheduled for removal must be checked (or sampled as necessary per regulations) for PCB, a potential hazardous or regulated waste. If PCBs are identified, remove and dispose of in compliance with California Code of Regulations (CCR), Title 22 Division 4.5; Title 49 CFR, Parts 100 to 185; Title 40 CFR, Parts 750 and 761 and Edwards AFB Hazardous Waste Management Plan (as applicable). The proponent/ contractor shall coordinate PCB removal, storage and disposal activities with 412 CEG/CEV.

Chlorofluorocarbon (CFC). Project scope may involve use, alteration or disposal of CFC-containing equipment. Some CFCs are considered ozone-depleting substances. The proponent/contractor shall coordinate the appropriate use, capturing and recycling of CFC. Contact 412 CEG/CEV for CFC use and/or disposal.

Permits. Rinse water or solids separated in oil/water separator systems that are deemed a hazardous waste may require a tiered permit from the Department of Toxic Substances Control IAW California hazardous waste regulations. The proponent/contractor shall contact 412 CEG/CEV for tiered permitting requirements.

Projects involving the closure and removal of an underground storage tank (UST) and/or piping must follow the draining, notification, sampling and reporting guidelines set forth in the

Kern County Environmental Health Services Department (KCEHSD) UT-30 Handbook, *Requirements for Permanent Closure of Underground Hazardous Substance Storage Tanks* and Article 7 of Title 23 California Code of Regulations, Division 3, Chapter 16, Underground Storage Tank Regulations. The project shall also obtain a closure permit from the KCEHSD by notifying them at least 30 days prior to tank removal.

Hazardous Liquid Pipelines. New hazardous liquid pipeline construction that affects the Edwards AFB JET A hazardous liquid pipelines (including line pipe, valves, pumping units, meters, breakout tanks and other appurtenances) must be coordinated with KCEHSD. The contractor/proponent shall contact 412 CEG/CEV who will coordinate with KCEHSD as required.

9.8 Cultural Resources

The AF policy for cultural resources integrates historic preservation requirements with planning and management of other activities, and considers historic resources during the earliest stages of project planning. The National Historic Preservation Act of 1966 establishes the responsibilities of Federal agencies to preserve historic and prehistoric resources. Any property (site, structure or both) that may qualify for listing on the National Register of Historic Places must not be inadvertently demolished, altered or allowed to deteriorate. The Archaeological Resource Protection Act of 1979 also protects all archaeological resources from illicit use, including excavation and removal from Federal lands. The AF and Edwards AFB are required to identify, protect and use the historic resources under its control.

The AF encourages practical rehabilitation and adaptive reuse of existing properties when operational needs can be supported. Whenever feasible, existing properties must be used before acquiring, constructing or leasing new buildings. Guidelines for rehabilitating and maintaining historic properties may be found in the Secretary of the Interior's Standards for Rehabilitation and Guidelines for Rehabilitating Historic Buildings.

Historic Facility Determination. The prime contractor shall contact the Base Historic Preservation Officer (BHPO) in 412 CEG/CEV to identify the current list of historic facilities present within the project's area of potential effect. If historic sites and/or cultural resources are identified, they may not be modified or demolished without completion of a review through the BHPO. Any proposed work (undertaking) inside, on or in the vicinity of a historic property (structure or site) as identified above shall be presented to the BHPO at the earliest possible stage in the planning process for areas to avoid, monitoring requirements and project scheduling.

The designer must coordinate the proposed work with the BHPO. Any project requiring coordination with the State Historic Preservation Officer (SHPO) will need to incorporate into the planning process a 45-day review cycle, typically at the 30-35 percent and 90-95 percent design stages. All coordination with the SHPO is accomplished by 412 CEG/CEV.

Archeological Discovery. If artifacts or bones are discovered during project activities, the project activities shall cease immediately and the project foreman shall immediately contact 412 CEG/CEV.

Cultural Resources Education. The proponent/contractor shall ensure all field workers complete a cultural resources awareness education program before commencing fieldwork. Contact 412 CEG/CEV at least 3 days prior to starting work to arrange for this awareness briefing. If additional personnel are brought onto the project after the initial briefing, then the proponent/contractor must contact 412 CEG/CEV for the new personnel to receive a cultural resources briefing prior to working on the project.

9.9 Environmental Restoration Program (ERP)

The Edwards AFB ERP is regulated under the Comprehensive Environmental Response, Compensation, and Liability Act, 1980 and the Superfund Amendments and Reauthorization Act, 1986. The ERP identifies, investigates and remediates all past hazardous waste sites.

Project design shall take into account any activities within the boundary of any ERP site. The Land Use Control Implementation Plan shall be referenced. ERP site maps and the Land Use Control Implementation Plan may be obtained from AFCEC Installation Support Team Edwards AFB (AFCEC/CZOW). Damage to ERP equipment and infrastructure shall be avoided. Project activities shall not restrict AFCEC/CZOW access to existing monitoring wells and/or ERP equipment and infrastructure.

If project construction, grading, excavation and/or trenching activities may conflict with ongoing contaminated soil or groundwater remediation activities or is located in close proximity to ERP remediation equipment or utilities, the activity must be coordinated with the ERP Program Manager. The ERP Program Manager must work with the project proponent to ensure that the project shall not interfere with ERP activities or ERP equipment.

Trenching and digging below the ground surface in any ERP site may result in encountering soil or groundwater with contamination at levels above health-based risk concentrations and may require a site-specific health and safety plan. This must be prepared by the project contractor prior to the start of any intrusive work at the site. During excavation activities where soil and/or groundwater in the area may be contaminated, workers may be exposed to contaminants through inhalation or dermal contact. Contact Bioenvironmental Engineering regarding health and safety plan concerns.

If the proponent/contractor notices soil discoloration or odors during site activities, they shall cease site activities and report this observation immediately to Bioenvironmental Engineering for additional information about this ERP site. The ERP Program Manager shall provide any available information about contaminants at the ERP site.

For new facility construction projects, the proponent/contractor must coordinate with the ERP Program Manager to ensure the facility design considers appropriate built-in vapor intrusion mitigation measures (e.g., vapor barrier membrane, sub-slab depressurization system), as warranted, based on contamination conditions. An Active Soil Gas Survey may be necessary as part of the design/construction project (MILCON) to determine if any built-in vapor intrusion mitigation measures are necessary.

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9.10 Grading and Fill Materials

The use of fill material from an on-base borrow pit shall come from an approved borrow site as described in the Environmental Assessment for Borrow Sites at Edwards AFB, California as conducted by the USACE and AFTC 1996. A desert tortoise pre-survey is required at least 48 hours prior to activity commencing at an on-base borrow pit. Fill material from an off-base borrow source shall be obtained from a State-licensed borrow area that has appropriate environmental clearances under the California Environmental Quality Act. Contact 412 CEG/CEV for coordination to determine appropriate borrow areas and applicable operating requirements to ensure compliance with natural and cultural resource regulations. Fill material from off-base should also be certified weed-free to ensure compliance with E.O. 13112.

All vehicles will be staged within previously disturbed areas. Grading shall only occur within previously graded areas unless pre-coordinated with 412 CEG/CEVA. For example, no new construction of roads or widening of graded road shoulders may occur. If grading activities cannot be completed within two consecutive days, notify 412 CEG/CEV Natural Resources at no less than three days and no more than five days before work resumes.

Road Shoulder Grading Coordination Requirement. If project activities require grading of the road shoulder, the shoulder shall not be widened, nor shall habitat be disturbed or destroyed without receiving guidance from 412 CEG/CEV.

9.11 Natural Resources

AFI 32-7064, *Integrated Natural Resources Management*, guides installations in managing their natural resources programs. DoD Instruction 4715.03, *Natural Resources Conservation Program*, issued in 2011, established requirements for the coordination and integration of natural resources programs with other base activities:

- All projects shall be evaluated through the EIAP process and coordinated with the 412 CEG/CEV Base Natural Resources Manager.
- Contact Bioenvironmental Engineering for information regarding proper mold and rodent waste remediation techniques.
- Coordinate with the Natural Resources Manager if any work requires the disruption of soil and/or removal of vegetation, regardless of location.
- Revegetation/restoration will be required based on the level of disturbance created from project activities. Revegetation/restoration shall be IAW the Edwards AFB Revegetation Plan.
- Herbicides must be applied IAW the Integrated Pest Management Plan. Physical, mechanical, or other measures must be used to remove or control weeds. Least hazardous, but effective, herbicides are used as a last resort. Contact Pest Management with any questions.

Desert Tortoise Protection Requirements. The desert tortoise is a Federally-listed threatened species under the Endangered Species Act of 1973. This Act prohibits "take" of

threatened species. The term "take" means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect or to attempt to engage in any such conduct. All project personnel working in the area shall attend desert tortoise awareness training prior to commencing work or visiting the work site. For any ground disturbing activity a desert tortoise presurvey may also be required prior to commencing work. Contact 412 CEG/CEV no less than three days and no more than five days before work begins to schedule a desert tortoise awareness briefing and/or presurvey.

Open excavations of any kind created during project activities shall be secured at the end of each day by backfilling, placing a cover over the excavation, installing a temporary Environmental Management approved desert tortoise fence and/or creating a 3:1 slope at the ends of the ditch. Excavations left unsecured during the workday shall be checked three times per day (morning, midday and late afternoon) for trapped animals. If any animals are found in an excavation, immediately notify 412 CEG/CEV.

Desert tortoises and their burrows shall be avoided. All project personnel shall inspect under all vehicles and equipment for desert tortoises prior to operation. Any sightings of desert tortoise or burrows within the project site must be reported immediately to the monitoring biologist or 412 CEG/CEV. Any pipes stored within the area shall be capped on open ends or elevated at least 12 inches off the ground to prevent entry by desert tortoise or other wildlife from entering the piping. Project personnel shall use existing access roads and staging areas, and follow flagged access routes that have been surveyed or cleared of desert tortoises. Vehicles will be staged within previously disturbed areas.

All trash and recyclable material shall be contained within raven-proof (covered) containers and removed from the project site weekly to approved trash and recycling or facilities.

Migratory Bird Protection Requirements. Migratory birds are protected under the Migratory Bird Treaty Act (MBTA). The MBTA protects most birds and their active nests (nests with egg or young). Migratory birds nest in the Edwards AFB area yearly (nesting season is typically February to August, but some birds can nest year round). Nests may occur on the ground, in burrows or culverts, in vegetation (such as cattails) or on manmade structures (such as buildings, radar towers, static plane displays, catwalks, rafters, etc.). Active nests (nest with eggs or unfledged birds observed in the nest) cannot be removed or moved without obtaining a Depredation Permit from United States Fish and Wildlife Service (USFWS) prior to the commencement of activities. Only authorized 412 CEG/CEV staff can remove nests. Design and construction of the proposed facility should *minimize* potential nesting sites for birds. Anti-perching devices shall be installed to deter birds from perching on the structure. Before any demolition of structure(s), shrub or tree removal/disturbance occurs during the nesting season (February to August) a migratory bird nest pre-survey shall be conducted to avoid violating the MBTA. Contact 412 CEG/CEV no less than three days and no more than five days before the start of the project to schedule a migratory bird nest pre-survey if conducting work within the nesting season. Failure to comply with the MBTA could result in fines up to $15,000 and six months in jail.

If project activities cannot occur outside of the nesting season and an active nest is identified, a Depredation Permit from the USFWS must be obtained prior to commencement of activities. Contact 412 CEG/CEV for assistance.

Bat Protection Requirements. A bat pre-survey is required for all exterior renovation and demolition projects. Contact 412 CEG/CEV no less than 3 days and no more than 5 days before the start of the project, including abatement activities, to schedule a bat pre-survey. If at risk/sensitive or listed species of bats are observed, passive exclusion methods will be required. Consult with 412 CEG/CEV if passive exclusion methods are deemed necessary. If a building is found to support a maternity colony, the proponent/contractor shall make every effort to avoid demolition during the breeding season.

If an active bat roost is found at the project site, the project sponsor and/or contractor shall immediately suspend operations in the area of discovery and notify 412 CEG/CEV. Construction operations can continue in other areas of the project unless otherwise directed by 412 CEG/CEV. Contact 412 CEG/CEV if bats are observed roosting in the project area.

Mohave Ground Squirrel Protection Requirements. Mohave Ground Squirrels are a threatened species under the California Endangered Species Act. Contact 412 CEG/CEV no less than three days and no more than five days before prior to ground disturbance for assistance in developing measures to avoid adverse impacts to Mohave ground squirrel habitat.

Sensitive Plant, Mesquite Tree, Shrubs and Joshua Tree Protection Requirements. If this project would remove or impact any of the above, the proponent/contractor shall be required to restore the site IAW the Base Revegetation Plan. Contact 412 CEG/CEV no less than three days and no more than five days prior to ground disturbance for assistance in developing measures to avoid adverse impacts to sensitive plant species, Mesquite trees, shrubs and/or Joshua Trees.

Environmentally Preferable Products and Services. Edwards AFB requires use of environmentally preferable products and services where possible. Environmentally preferable products and services are those which have a reduced impact on human health and the environment. Federal agencies are required to procure environmentally preferable products and services in support of markets for recycled materials and products containing recycled materials. The U.S. Environmental Protection Agency (USEPA) has designated guideline items in the Comprehensive Procurement Guidelines (CPG), which when meeting certain criteria, Federal agencies are required to purchase to the maximum extent practical. These CPG products are products that are or can be made containing recycled materials. In the CPG, the EPA organizes these items into 8 product categories as follows:

- Construction Products
- Landscaping Products
- Non-paper Office Products
- Paper and Paper Products
- Park and Recreation Products
- Transportation Products
- Vehicular Products
- Miscellaneous Products

The requirements for purchasing these items are listed on EPA's web site at: http://www.epa.gov/cpg/products.htm. Once in the web site, to view the products, click on one of the eight categories and on a specific product to determine the product's Recommended

Recovered Materials Content Levels, Product Specifications, Product Information and a list of manufacturers and suppliers.

Federal agencies are required to purchase these designated guideline items containing the highest percentage of recovered materials IAW the Resource Conservation and Recovery Act, Section 6002 (42 U.S.C. 6962); Executive Order 13101, *Greening the Government through Waste Prevention, Recycling, and Federal Acquisition*; and Title 40, Code of Federal Regulations (CFR) Part 247, *Comprehensive Procurement Guideline for Product Containing Recovered Material*.

The contractor is required to research, propose, and utilize these designated products, and any other recycled-content products available in the market place. CPG products with the highest percentage of recovered materials practicable shall be utilized, unless otherwise specified, or if one or more of the following exemptions apply:

- Does not meet appropriate performance specifications
- Is not available competitively (from two or more sources)
- Is not available within a reasonable time frame
- Is only available at an unreasonable price

A Green Procurement Fact Sheet is provided as a guide to designers and construction agents to comply with guidelines and regulations for Affirmative Procurement program and identification of environmentally preferable products manufactured from recycled and reclaimed materials. Additional information concerning this fact sheet and Affirmative Procurement can be obtained from 412 CEG/CEV.

9.12 Radon

AFI 48-148, *Ionizing Radiation Protection*, Section 5.3, describes the requirements to protect members of the public from radon in AF controlled structures. The 1987 Radon Assessment and Mitigation Program provides AF structures testing guidance. Based on this guidance, required testing completed in April 1988 and March 1991, resulted in Edwards AFB being designated a "Medium Risk" installation. Per Section 2.2.3 Edwards must: "Incorporate radon reduction measures in the construction of new facilities at medium and high risk installations as required in current DoD and AF policy).

Testing and construction requirements can be found in the following:

- AFI 48-148 *Ionizing Radiation Protection 20 Nov 14*
- EPA 402-R-93-078 *Radon Mitigation Standards Apr 1994*

Chapter 10 Intrusion Detection System (IDS) – (Alarms)

All Edwards AFB IDS are procured and operated according to governing AF directives and local direction. IDS's must comply with the following:

- AFI 31-101 *Integrated Defense (FOUO)*
- DoD 5100.76 *Physical Security of Sensitive Conventional Arms, Ammunition and Explosives*
- AFI 31-401 *Information Security Program Management*
- EOP 16-1 *AAFES Security Procedures*
- JAFAN 6/9 *Physical Security Standards for Special Access Program Facilities*
- ICD/ICS 705 *Technical Specification for the Construction and Management of Sensitive Compartmented Information Facilities*
- NISPOM *National Industrial Security Program Operating Manual*

10.1 Approval Requirements

Security Forces Squadron Design Approval Requirements. The 412th Security Forces Squadron (412 SFS) is solely responsible for managing and monitoring the Edwards AFB IDS and duress alarms for Edwards AFB. New IDS or modifications to existing IDS must receive design and operational approval from the 412 SFS/S5E Installation Security Office. The purpose of the design review is to ensure full integration of all Intrusion Detection Equipment with the Edwards AFB IDS, a legitimate level of security, employment of proper devices and suitable device locations. A scaled floor plan of the proposed alarm system must be provided to 412 SFS/S5E and 412 CEG/CENME.

After a proposal or modification of a IDS has been approved by the 412 SFS/SFOSE, the 412 CEG Project Management Branch (412 CEG/CENM) must review the floor plans, detection system design and written specifications. The purpose of the review is to evaluate the functional and serviceability aspects of the system and compliance with code standards. A system will not receive an account number or telephone pair designation until this step is accomplished. 412 CES/CEOF must be notified of all proposals and or modifications.

10.2 IDS Design Requirements (Control Panels)

The Intrusion Alarm (IA) control panel shall do all of the following:

- Communicate bi-directionally by means of identical software protocol, without shunt to the Security Forces Control Center (SFCC) IDS computer
- Communicate with the Edwards AFB SFCC IDS computer by means of a dedicated wire pair at 37200 Baud, full duplex, without the use of servers or auxiliary relays or shunted equipment
- Respond to programming solely from the Edwards AFB SFCC IDS computer

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- Be capable of executing a walk test (test of detectors) directly from the IA keypad and simultaneously provide security protection. The walk test shall not terminate until the test is completed and test results shall be generated at both the IA keypad and the SFCC IDS computer
- Be capable of monitoring a minimum of 140 class B, supervised, hard-wired, loops (N/C or N/O or both.) There shall be an additional hard wired N/C loop dedicated for cabinet tamper. Tamper shall be connected to zone 12 in the control panel.
- Contain circuitry for an integrated audio intrusion control security system and communications interface. Exception: Special Access Program Facility (SAPFs) or Sensitive Compartmented Information Facilities (SCIFs)
- The IA account number and user(s) personal identification number shall be programmed exclusively from the Electronic Security Systems (ESS) NCO workstation. This is not a requirement if the IDS is established within a SAPF or SCIF.
- The field IA control panel shall provide a programmable auxiliary output which can be controlled or operated from the Edwards AFB SFCC IDS computer. The output shall be capable of controlling closed circuit television devices and/or turning on/off multiple devices.
- Accessing or securing a protected area shall be accomplished with an intelligent keypad interface.

Control Panel Keypads. Keypad life cycle shall be greater than 1,000,000 cycles. It shall have a capacity for at least 9,000 dissimilar access codes and a lockout feature after an invalid access code has been entered three times in sequence, and shall provide programmable audible indication during delayed entry or exit period. It shall have audible prompting and the ability to initiate a duress code.

10.3 Installation Standards

General. Installation must be IAW all manufactures' written instructions and recommendations. Verbal changes to these written instructions (even if provided by the manufacturer) are not acceptable. Proposed manufacturer exceptions documented by letter or FAX must be approved by both 412 SFS/S5E and 412 CEG/CENMP prior to implementation.

Within each IA control panel, the location of the control panel power supply electrical breaker shall be annotated. The IA control panel shall be grounded to the facility equipment ground. The IA control panel shall not be grounded to the telephone signal ground. In the event of electrical power failure, battery backup sufficient to provide at least 12 hours of complete protection shall be provided. A minimum of two batteries will be installed with each panel and/or power supply.

If more detection zones are required than a single IA control panel is capable of accommodating, supplementary expansion modules shall be installed within 10 feet if possible but no more than 100 feet of the IA control panel. Connections between the control panel and conduit shall be made through manufacture supplied knock-outs or ports in the control panel. Control panel cabinets will not be modified without prior written approval of 412 SFS/SFOSE and 412 CEG/CENMP. The IA control panel and expansion modules shall be centrally

located within the protected area and mounted at a height of 60 inches AFF.

Prior to the scheduled IA pre-test, the contractor/installer shall provide 412 SFS/SFOSE an accurate type written IA control panel program. Changes to the IA program following the initial system program input shall be provided to the government at least 48 hours in advance of IA testing or use.

Detection Loop. Each IA sensor/device loop shall meet Class B wiring standards, be wired to a dedicated zone within the IA control panel and shall not share a loop with a second device. All alarm loops which exit the panel or loop expansion enclosure will be supervised with a resistor terminated at the device. The area protected by each IA control panel loop/zone shall be labeled within the control panel cabinet.

Each IA detector tamper and each standalone tamper switch shall be wired to a dedicated zone in the IA control panel. A tamper shall not share a loop/zone with a second tamper or device.

Detection Devices. Wall mounted detection devices used for volumetric intrusion detection shall be adjustable, and adjustments shall be made without having to remount the device. High security balanced magnetic (triple biased) switches shall be used and the magnetic tamper shall be utilized.

Wiring. Detection devices shall not be installed in series configuration. Each detector signaling loop, each power loop and each tamper loop shall be dedicated to a device.

Splicing of detection loops shall be kept to a minimum. If splicing of detection loops is required, the splice shall be located within a tampered box. Terminal strips shall be used in locations were multiple termination points are used; e.g. troughs.

Each detection loop shall be installed within grounded conduit. The loop wire shall be 22-AWG in size; shall be shielded, stranded and possess a drain wire should grounding be necessary. Detection loop end of line resistor shall be terminated at the device. Wiring in the control panel shall meet or exceed industry standards.

IA wiring shall be isolated and shall not share conduit or junction boxes with other wired systems. The wiring within all conduits will meet or exceed the National Electric Code (NEC) requirements. IA conduit installed parallel with alternating current (AC) conduit shall be no closer than 6 inches to conduit housing AC power.

Power Supply. A 120V AC circuit shall be dedicated to the IA control panel. The electrical breaker controlling the control panel receptacle shall be dedicated solely to the intrusion alarm.

Communications. The wire used for communication between the IDS control panel and the telephone block shall be solid, 22 AWG telephone company wire and installed in grounded conduit.

10.4 Post Installation Acceptance Testing

After IDS installation is complete and the installer/contractor has successfully tested the system, 412 SFS/S5E shall be contacted for an acceptance test. At that time the installer/ contractor will provide 412 SFS/S5E a list of the point's identification and location.

At the time of the final acceptance test, the installer/contractor will provide control panel keys, device cut sheets, power supply calculations, a copy of the wiring diagrams and transponder programs to 412 SFS/SFOSE. Diagrams and programs will not be given to the facility manager, user or interested personnel without written consent from 412 SFS/S5E. The contractor shall provide all tools, ladders and manpower required to conduct the acceptance test. The contractor shall provide an operators manual and training for the system user.

The acceptance test will include but is not limited to inspection and operation of each device, tamper, detection loop and junction box. If any part of the detection system fails or if flaws in craftsmanship are detected, the test will be terminated. An acceptance test consists of the three main components:

- Examination and testing of devices, components and detection loop wiring
- Functional test of the system on battery backup without commercial/primary power
- A 72-hour burn-in (false alarm test)

10.5 System Activation

Following completion of a successful Acceptance Test by 412 SFS the contractor shall not re-enter the IDS. When all requirements are met and prints received the system will be activated at the 412 SFS central station.

Chapter 11 Fuels

Design and Installation of Fuel storage tanks and dispensing systems shall comply with the latest revisions of all applicable Federal, State, Local codes and regulations including but not limited to the following:

- UFC 3-460-01 *Petroleum Fuel Facilities*
- UFC 3-460-03 *Operation And Maintenance - Maintenance of Petroleum System*
- NFPA 30 *Flammable and Combustible Liquids Code*
- NFPA 30A *Motor Fuel Dispensing Facilities And Repair Garages Code*
- NEC Article 513 *Aircraft Hangars*
- ANSI B31.3 *Pressure Piping*
- NFPA 70 *National Electrical Code*
- API 650 *Welded Steel Tanks for Oil Storage*
- API 2000 *Venting Atmospheric and Low-Pressure Storage Tanks*
- PEI RP200-92 *Recommended Practices for Installation of Aboveground Storage Systems for Motor-Vehicle Fueling*
- UL 971 *Nonmetallic underground piping for petroleum products,*
- UL 142 *Steel Aboveground Tanks for Flammable and Combustible Liquids*
- UL 2085 *Insulated Aboveground Tanks for Flammable and Combustible Liquids*
- UL File MH9162 Gasoline-alcohol blends, Alcohol's such as methanol and etha nol, and reformulated fuels
- Uniform Fire Code: Article 52, Article 79 and Appendix II-F
- Building Officials and Code Administrators -Fire Prevention Code

All work accomplished shall conform to or exceed the requirements of the above referenced codes, regulations and standards; provided, that whenever the provisions of said publications are in conflict with the requirements specified herein, the stringent requirement shall apply. Installation of fuel tanks may also be subject to the same requirements listed in Section 9.5 Hazardous Materials, subsection Storage Tank Permit Requirements.

11.1 Fuel Tanks

Fuel tanks installed above ground and conform to the requirements of State Water Resources Control Board regulations of Title 23, Division 3 and Chapter 16. Underground tanks are generally not allowed. All California businesses with UST are subject to the regulations set forth in Chapter 6.7 of the California Health and Safety Code and Title 23, Division 3, Chapter 16 of the CCR. Removal of tanks must be closely coordinated with 412 CEG/CEV and comply with Kern County Handbook UT 30. A closure permit shall be obtained from the KCEHSD by notifying them at least 30 days prior to tank removal. Within one week following tank removal, the proponent/contractor shall also notify EKAPCD.

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Appropriate secondary containment and/or diversionary structures or equipment to prevent a discharge shall be provided. The entire containment system, including walls and floor, must be capable of containing fuel; constructed so that any discharge from a primary containment system, such as a tank or pipe, will not escape the containment system before cleanup occurs. Appropriate containment should be designed to address the most likely discharge from the primary containment. Examples of appropriate containment would be dikes, retaining walls, drivable berms, concrete or asphalt apron surrounded by a concrete curb, directed flow to collection points for recovery, weirs and booms.

The proponent/contractor shall comply with Title 22, Sections 67383.1 to 67383.5 of the California Code of Regulations for proper removal guidelines for ASTs, associated piping, and appurtenances. All tanks and piping must be properly flushed and purged of hazardous materials. The contractor shall inspect concrete pads and the underlying soil at the tank removal location for any visual discoloration and take appropriate soil (or wipe) samples to verify visual discoloration is not a result of prior contamination. The proponent/contractor is instructed to contact 412 CEG/CECV for additional guidance and requirements.

11.2 Pipelines

All work performed on Edwards AFB's pipeline facilities (pipelines, breakout tanks, pump stations, etc.) is regulated by KCEHSD and Certified Unified Program Agencies (CUPA). All work performed must comply with KCEHSD, CUPA and 49 CFR Part 195, *The Elder California Pipeline Safety Act* (California Government Code Sections 51010-51019).

Any new pipe installed in a pipeline system must comply with the following: Title 49-Transportation, Part 195 – Transportation of Hazardous Liquids by Pipeline, Subpart C – Design Requirements and Subpart D – Construction. The new pipe line should have leak monitoring system and cathode protection. Hazardous liquid pipeline transporting liquid in single phase (without gas in the liquid). All new pipeline installation requires computational pipeline monitoring leak detection system. Fiberglass piping is not allowed for fuel system.

For removal, the testing of the soil surrounding the tank will be required and should be included in the work plan submitted to KCEHSD. Removal of piping and appurtenances shall also comply with Title 22, Chapter 32, Sections 67383.1 to 67383.5 of the California Code of Regulations.

APPENDIX A Revision Form

Revision or Variance (circle one)	Page Number	Page and Paragraph Number	Date Submitted
Provide exact wording for revision or variance desired			
Reason for Proposed Revision			
FOR CIVIL ENGINEERING USE ONLY			
Proposal #	Date Received:	Date of Action:	
Action:			

Duplicate as necessary (one proposed revision per sheet, please) and submit to:

Mr. Hugo Via
Chief, Project Execution
412 CEG/CENMP
225 N. Rosamond Blvd.
Edwards AFB, CA 93524
Phone (661) 275-3509

or email to: **hugo.via.2@us.af.mil**

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APPENDIX B Acronyms

AAFES	Army & Air Force Exchange Services
AASHTO	American Association of State Highway Traffic Officials
ACC	Asphalt Cement Concrete
ADA	American with Disabilities Act
AF	Air Force
AFB	Air Force Base
AFBI	Air Force Base Instruction
AFCEC	Air Force Civil Engineering Center
AFI	Air Force Instruction
AFJMAN	Air Force Joint Manual
AFMAN	Air Force Manual
AFMC	Air Force Materiel Command
AFOSH	Air Force Occupational Safety and Health
AFPAM	Air Force Pamphlet
AFRL	Air Force Research Laboratory
AFTC	Air Force Test Center
AGA	American Gas Association
AHU	Air Handling Unit
ANSI	American National Standards Institute
API	American Petroleum Institute
ASHRAE	American Society of Heating, Refrigeration, and Air Conditioning Engineers
AST	Above Ground Storage Tank
AT/FP	Anti-Terrorism, Force-Protection
AVAQMD	Antelope Valley Air Quality Management District
AWG	American Wire Gage
BACnet	Building Automation Control Network
BASH	Bird Aircraft Strike Hazard
BCE	Base Civil Engineer
BTU	British Thermal Unit
BUR	Built-Up Roof
CAD	Computer Aided Design
Caltrans	California State Department of Transportation
CaMUTCD	California Manual of Uniform Traffic Control Devices
CCD	Consolidated Composite Drawings
CCR	California Code of Regulations
cd	compact disc
CE	Civil Engineer
CEC	California Energy Commission
CEV	Environmental Management
CFC	Chloroflourocarbons
CFR	Code of Federal Regulations
CMU	Concrete Masonry Unit
CPG	Comprehensive Procurement Guidelines
DoD	Department of Defense
EFIS	Exterior Finish Insulation System
EIAP	Environmental Impact Analysis Process
EKAPCD	Eastern Kern Air Pollution Control District
EMCS	Energy Management and Control System
EOP	Emergency Operations Plan
EPA	Environmental Protection Agency
EPACT 05	Energy Policy Act of 2005
ERP	Environmental Restoration Pro gram

ETL	Engineering Technical Letter
FACP	Fire Alarm Control Panel
FRT	Fire Retardant-Treated
FSC	Forest Stewardship Council
GIS	Geographic Information Systems
HDPE	High Density Polyethylene
HM	Hazardous Material
HMMP	Hazardous Material Management Plan
HVAC	Heating, Ventilation, and Air Conditioning
Hz	Hertz
IAW	In Accordance With
IA	Intrusion Alarm
IBC	International Building Code
ICC	International Code Council
ICS	Industrial Controls System
IDS	Intrusion Detection System
IEEE	Institute of Electrical and Electronics Engineers
IESNA	Illuminating Engineering Society of North America
IFC	International Fire Code
KCEHSD	Kern County Environmental Health Services Department
kW	Kilowatt
LED	Light-emitting diode
LEED®	Leadership in Environmental and Energy Design
MAJCOM	Major Command
MDAQMD	Mojave Desert Air Quality Management District
MILCON	Military Construction
MNS	Mass Notification System
mph	miles per hour
NACE	National Association of Corrosion Engineers
NEC	National Electric Code
NEMA	National Electrical Manufacturers Association
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NHPA	National Historic Preservation Act
NICET	National Institute for Certification in Engineering Technologies
NFPA	National Fire Protection Association
NRTL	Nationally Rated Testing Laboratory
NSPS	New Source Performance Standards
OSHA	Occupational Safety and Health Administration
PCB	Polychlorinated Biphenyl
PCI	Pavement Condition Index
PCC	Portland Cement Concrete
P.E.	Professional Engineer
PEI	Petroleum Equipment Institute
PIRA	Precision Impact Range Area
PM	Project Manager
psf	Pounds Per Square Foot
PVC	Polyvinyl Chloride
RAP	Reclaimed Asphalt Pavement
RICE	Reciprocating Internal Combustible Engine
SAPF	Special Access Program Facility
SCADA	Supervisory Control and Data Acquisition
SCAQMD	South Coast Air Quality Management District
SCIF	Sensitive Compartmented Information Facility
SEER	Seasonal Energy Efficiency Ratio
SFCC	Security Forces Control Center
SFS	Security Forces Squadron

SWPPP	Storm Water Pollution Prevention Plan
TES	Thermal Energy Storage
TM	Army Technical Manual
TW	Test Wing
UFAS	Uniform Federal Accessibility Standards
UFC	Unified Facilities Criteria
UFGS	Unified Facility Guide Specifications
UL	Underwriters Laboratory
USAF	United States Air Force
USACE	United States Army Corps of Engineers
USGBC	United States Green Building Council
UST	Underground Storage Tank
VFD	Variable Frequency Drive
VOC	Volatile Organic Compound

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